MAYFLOWER WIND

Prepared for:
Mayflower Wind Energy LLC

Final Essential Fish Habitat and Protected Fish Species Assessment

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AECOM Imagine it. Delivered.

Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
0	2/13/21	For Submittal	Yes	Kristen Durocher	Deputy Project Manager
1	8/27/21	Revised to include Brayton Point and updated Falmouth Project Design Envelope, and in response to BOEM comments	Yes	Kristen Durocher	Deputy Project Manager

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Acronyms and Abbreviations

Abbreviation or Acronym	Definition
μPa	micro Pascal
°C	degrees Celsius
°F	degrees Fahrenheit
ASMFC	Atlantic States Marine Fisheries Commission
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Register
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	centimeters
CMECS	Coastal and Marine Ecological Classification Standard
COP	Construction and Operations Plan
cSEL	cumulative sound exposure level
dB	decibel
EC	Export Cables
ECC	Export Cable Corridor
EFH	Essential Fish Habitat
ELMR	Estuarine Living Marine Resources
EMF	Electromagnetic Field
FL	Fork Length
FMC	Fisheries Management Council
FMP	Fishery Management Plan
ft	foot/feet
g	grams
GAFMC	Greater Atlantic Fishery Management Council
GARFO	Greater Atlantic Region Fisheries Office
GIS	geographic information system
ha	hectare
HAPC	habitat areas of particular concern
HDD	Horizontal Direct Drilling
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
IAC	Inter-Array Cables
IISD	International Institute for Sustainable Development
in	inches
IPF	Impact-Producing Factor
kg	kilogram
km	kilometer
kV	kilovolt
lb	pound
Lease Area	Lease Area OCS-A 0521
LC10	Lethal Concentration to 10 percent of organisms
m	meter
MA DFW	Massachusetts Division of Fish and Wildlife
MA/RI WEA	Massachusetts/Rhode Island Wind Energy Area

Abbreviation or Acronym	Definition
MAFMC	Mid-Atlantic Fishery Council
MassDMF	Massachusetts Division of Marine Fisheries
Mayflower Wind	Mayflower Wind Energy LLC
mg/L	milligrams per liter
mi	statue mile
MLLW	Mean Lower Low Water
msec	millisecond
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSIR	Marine Site Investigation Report
NA	not applicable
NECC	Northern Export Cable Corridor (Falmouth)
NEFMC	New England Fishery Management Council
NEFSC	Northeast Fisheries Science Center
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
Ocean SAMP	Ocean Special Area Management Plan
OCS	Outer Continental Shelf
OSP	Offshore Substation Platform
OSRP	Oil Spill Response Plan
PKD	Plymouth, Kingston, Duxbury
POI	Point of Interconnection
ppt	parts per thousand
PV	Plan View
re	referenced to
RMS	root mean square
SECC	Southern Export Cable Corridor (Falmouth)
SEL	Sound Exposure Level
SPI	Sediment Profile Imaging
SPL	Sound Pressure Level
TL	Total Length
TTS	Temporary Threshold Shift
TSS	Total Suspended Solids
U.S.	United States
USC	United States Code
USFWS	United States Fish and Wildlife Service
WTG	Wind Turbine Generator
YOY	Young-of-the-Year

1.0 Introduction

Mayflower Wind Energy LLC (Mayflower Wind) proposes an offshore wind renewable energy generation project (the Project) located in federal waters off the southern coast of Massachusetts in the Outer Continental Shelf (OCS) Lease Area OCS-A 0521 (Lease Area). The Project will deliver electricity to the regionally administered transmission system via export cables with sea-to-shore transitions in Falmouth and Somerset, Massachusetts and onshore transmission system extending to the respective points of interconnection (POIs) in Massachusetts.

The Bureau of Ocean Energy Management (BOEM) has produced regulations and guidelines for preparing a Construction and Operations Plan (COP) as well as conducting specific technical studies to support COP development. Specific guidelines applicable to this essential fish habitat (EFH) characterization include:

- Information Guidelines for a Renewable Energy Construction and Operation Plan (COP) (BOEM, 2020a);
- Guidelines for Providing Geophysical, Geotechnical, and Geohazard Information Pursuant to 30 Code of Federal Register (CFR) Part 585 (BOEM, 2020b); and
- Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585 (BOEM, 2019).

In 2020, the National Marine Fisheries Service (NMFS) published Recommendations for Mapping Fish Habitat (NMFS, 2020) to clarify and supplement the BOEM benthic habitat survey guidelines. These Recommendations were updated in 2021 (NMFS, 2021).

1.1 Assessment Objectives

The objectives of this EFH and protected species assessment are to identify EFH, species and habit areas of special concern and threatened or endangered fish species in the Offshore Project Area, as required by BOEM (2020a). Findings of this report will provide technical information to support the development of the Mayflower Wind COP. The major objectives of this report are to:

- Identify EFH, Habitat Areas of Particular Concern (HAPC), species and life stages using EFH that may be affected by the Project;
- Identify threatened or endangered fish species that may be affected by the Project;
- Identify the potential for effects to EFH and the species dependent on these habitats; and
- Assist in the planning of activities, based on the life stages of species dependent on EFH present in the Offshore Project Area to limit potential direct and indirect impacts from the Project.

1.2 Report Organization

This report includes a general Project overview (Section 2.0), a description of the environmental setting (Section 3.0), a characterization of EFH and species in the Offshore Project Area (Section 4.0), and a characterization of effects (Section 5.0). Conclusions are provided in Section 6.0, and references are listed in Section 7.0.

2.0 Project Description

2.1 Project Overview

The Mayflower Wind Project includes a Lease Area located in federal waters south of Martha's Vineyard and Nantucket (Figure 2-1). Wind turbine generators (WTGs) constructed within the Lease Area will deliver power via inter-array cables to the offshore substation platforms (OSPs). The WTG/OSP positions have been established based on a 1 x 1 nautical mile (nm) (1.9 x 1.9 kilometer [km]) grid oriented along the cardinal directions to maintain a uniform spacing of WTGs across all the lease areas within the Massachusetts/Rhode Island Wind Energy Area. Submarine offshore export cables will be installed within offshore export cable corridors (ECCs) to carry the electricity from the OSPs within the Lease Area to the onshore transmission systems via two different ECCs. One ECC will make landfall in Falmouth, Massachusetts and the other will make landfall at Brayton Point, in Somerset, Massachusetts.

The proposed Falmouth ECC will extend from the Lease Area and enter Massachusetts state waters south of Nantucket Island and Martha's Vineyard, and pass through Muskeget Channel into Nantucket Sound. The offshore export cables will make landfall via horizontal directional drilling (HDD). Potential landing location(s) for the Falmouth ECC include Shore Street, Central Park, or Worcester Avenue in Falmouth, Massachusetts. The proposed Brayton Point ECC will run north and west from the Lease Area through Rhode Island Sound to the Sakonnet River. It will then run north up the Sakonnet River, cross land at Aquidneck Island to Mount Hope Bay, and then north into Massachusetts state waters to Brayton Point. Landfall will be made via HDD at one of two potential landing locations in Somerset on the western side of Brayton Point from the Lee River (preferred) or the eastern side from the Taunton River (alternate).

The Offshore Project Area includes the Lease Area, Falmouth and Brayton Point ECCs, and the HDD at the landfall locations.

For this report, the Offshore Project Area is further broken down into component areas along the ECCs to define specific habitats. These include:

1) Falmouth ECC includes the Falmouth ECC from the Lease Area, north through Muskeget Channel to within 0.6 miles (1 km) of the landfalls in Falmouth, Massachusetts. Consistent with COP Appendix M (Benthic and Shellfish Resources Characterization Report), the Falmouth ECC is further broken into the Southern ECC which is the segment south of Muskeget Channel and the Northern ECC which is the segment through and north of Muskeget Channel.
2) Worcester Avenue/Central Park Landfall.
3) Shore Street Landfall.
4) Brayton Point offshore ECC includes the Brayton Point ECC from the Lease Area west to the northern edge of Rhode Island Sound at the mouth of the Sakonnet River.
5) Sakonnet River ECC includes the ECC in the river from Rhode Island Sound to within approximately 0.6 miles (1 km) of the landfall on the south side of Aquidneck Island.
6) Aquidneck Island Landfalls include approximately 0.6 miles (1 km) on the north and south sides of the island where the ECC makes landfall.
7) Mount Hope Bay ECC includes the ECC from 0.6 miles (1 km) north of Aquidneck Island Landfalls north through Mount Hope Bay to within approximately 0.6 miles (1 km) of the Brayton Point Landfalls.
8) Brayton Point Landfalls include the western and eastern options for landfalls, within approximately 0.6 miles (1 km) of shore.

2.2 Specific Project Details

Each primary offshore Project component is briefly described below in Table 2-1. Additional details may be found in the COP Section 3 – Description of Proposed Activities.

Table 2-1. Key Project Details

Project Attribute	Description
Lease Area Size	127,388 acres (51,552 hectares [ha])
Layout and Project Size	Up to 149 WTG/OSP positions Up to 147 WTGs Up to 5 OSPs
WTGs	Rotor diameter: 721.7 – 918.6 feet (ft) (220.0 – 280.0 meters [m]) Blade length of 351.0 – 452.8 ft (107.0 – 138.0 m) Hub height above Mean Lower Low Water (MLLW): 418.7 – 605.1 ft (127.6 – 184.4 m)
OSP(s)	Top of topside height above MLLW: 160.8 – 344.5 ft (49.0 – 105.0 m)
WTG/OSP Substructures	Monopile, piled jacket, suction-bucket jacket, and/or gravity-based structure Seabed penetration: 0 – 295.3 ft (0 – 90.0 m) Scour protection for up to all positions
Inter-Array Cables	Nominal inter-array cable voltage: 60 kilovolts (kV) to 72.5 kV Length of inter-array cables beneath seafloor: 124.3 – 497.1 miles (mi) (200 – 800 km) Target burial depth (below level seabed): 3.2 – 8.2 ft (1 – 2.5 m)
Landfall Location(s)	Falmouth, MA Three locations under consideration: Worcester Avenue (preferred), Shore Street, and Central Park Somerset, MA Two locations under consideration: the western (preferred) and eastern (alternate) shorelines of Brayton Point Aquidneck Island, Portsmouth, RI Several locations under consideration for intermediate landfall across the island
Offshore Export Cables	Falmouth ECC Anticipated Cable Type: high voltage alternating current (HVAC) Number of export cables: up to 5 Nominal export cable voltage: 200 – 345 kV Length per export cable beneath seabed: 51.6 – 87.0 mi (83 – 140 km) Cable crossings: up to 9 Target burial depth (below level seabed): 3.2 – 13.1 ft (1 – 4 m) Brayton Point ECC Cable Type: high voltage direct current (HVDC) Number of export cables: up to 6 Up to 4 export power cables and up to 2 communication cables Nominal export cable voltage: ±320 kV Length per export cable beneath seabed: 97 – 124 mi (156 – 200 km) Cable/pipeline crossings: up to 16 (total) Target burial depth (below level seabed): 3.2 – 13.1 ft (1 – 4 m)

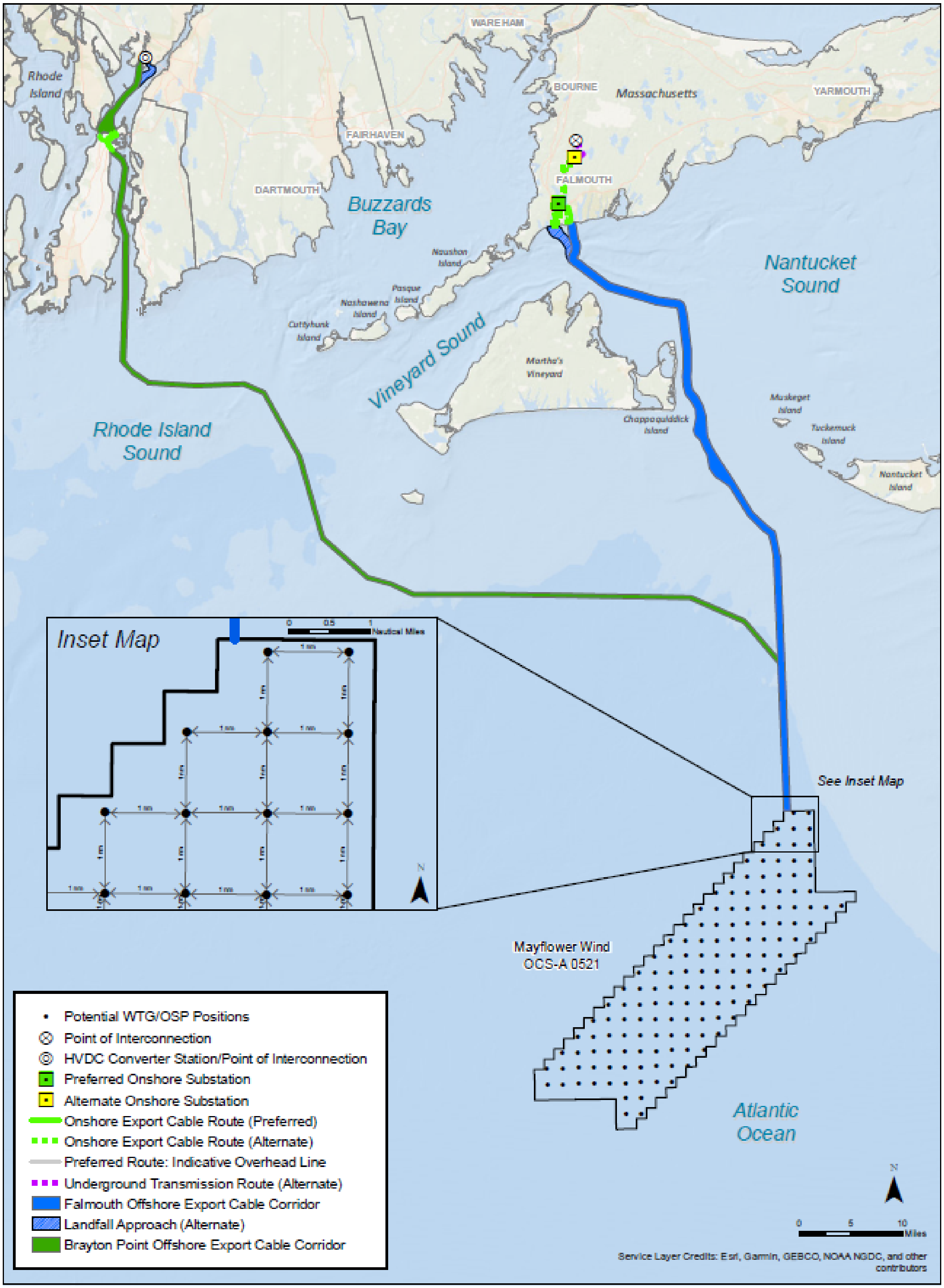


Figure 2-1. Location of Mayflower Wind Offshore Wind Renewable Energy Generation Project

3.0 Environmental Setting

This section provides: a brief description of habitats of the Offshore Project Area (including the Lease Area and ECCs) in which resident finfish, invertebrates, and highly migratory species live; a description of the types of species present; and a summary of protected species that may reside in the Offshore Project Area.

3.1 Habitats

The affected environment related to the Project consists of areas of habitat that may be designated as EFH for managed fish, shellfish, and mollusk species that reside within these habitats. Regional Fishery Management Councils (FMCs) and the National Oceanic and Atmospheric Administration (NOAA) work together to delineate and manage areas of EFH. As part of EFH management, descriptions of general habitats preferred by individual species are created and used as identification guides. Additionally, these agencies coordinate to create individual fishery management plans.

Official EFH data relevant to the Project are published by the New England Fishery Management Council (NEFMC) and Greater Atlantic Fishery Management Council (GAFMC). EFH data and text descriptions were downloaded from the NOAA Habitat Conservation EFH Mapper, an online mapping application (NOAA Habitat Conservation, 2020). EFH data were queried using geographic information system (GIS) software based on the Offshore Project Area. A 0.27 nm (0.5 km) buffer on the Falmouth export cable center line and a 0.19 nm (0.35 km) buffer on the Brayton Point export cable center line was used during queries to define the area.

New England waters have diverse habitats that are defined by their temperature, salinity, pH, physical structure, biotic structure, depth, and currents. The unique combination of habitat characteristics shapes the community of species that inhabit the area. Habitat types determine species, distribution, and predator/prey dynamics. Multiple factors directly affect spatial and temporal patterns of fish and shellfish species.

3.1.1 Physical Environment

The Mayflower Wind Lease Area and offshore ECCs lie on the continental shelf off southern New England. The northeastern edge of the Lease Area is about 20 nm (37 km) southwest of Nantucket Island, Massachusetts. From the northern edge of the Lease Area, the Falmouth ECC traverses similar submerged terrain as the Lease Area until it reaches a distinctly shallower area between Martha’s Vineyard and Nantucket Island into Nantucket Sound. This area, the Muskeget Channel, is a high-energy environment (see COP Appendix F2, Scour Potential Impacts from Operational Phase and Post-Construction Infrastructure). The strong currents produced by the geography of the channel have created a sea bottom that includes hard bottom habitats with shifting sand.

From the northern edge of the Lease Area, the Brayton Point ECC traverses similar submerged terrain as the Lease Area until it reaches a shallower area (approximately 100 ft [30 m]) southwest of Noman’s Island off Martha’s Vineyard. The Brayton Point ECC crosses this shallower area and turns north. The water depth increases slightly to approximately 130 ft [40 m] until it passes southwest of Cuttyhunk Island. Here the water becomes shallow as the ECC enters Rhode Island Sound at the mouth of Buzzards Bay. As the ECC enters the Sakonnet River, the water depth averages approximately 25 ft (8 m). Within 3,000 ft (914 m) of the landfall site(s) for Aquidneck Island, water depth is as shallow as 10 ft (0.9 m). In Mount Hope Bay to Brayton Point, water depths are greater (approximately 10 to 15 ft [0.9 to 1.5 m]).

Based on data from geophysical and geotechnical surveys (see COP Appendix E, Marine Site Investigation Report [MSIR]) conducted for the Project, the seafloor in the Lease Area is generally flat with slopes ranging from very gentle (<1.0°) to gentle (1.0° to 4.9°). Water depths range from 119 ft (36.4 m) below the MLLW datum at the northernmost end to 215 ft (65.6 m) below MLLW at the southernmost end. Locally, in the central portion of the Lease Area, ridges with moderate slopes (5.0° to 9.9°) are associated with shallow channels (Figure 3-1). About 65 ft (20 m) of recent (Holocene) sediments overlie Pleistocene terrestrial strata in the Lease Area.

The Lease Area and Falmouth ECC were classified according to the Coastal and Marine Ecological Classification Standard (CMECS) (Federal Geographic Data Committee, 2012; modified by National Marine Fisheries Service [NMFS], 2020). The sea floor was classified using sediment profile images (SPI), plan view (PV) images, and sediment grab sample grain size analysis from samples collected during the 2020 benthic surveys (COP Appendix M, Benthic and Shellfish Resources Characterization Report). These data were used in conjunction with the acoustic data collected by Fugro (COP Appendix E, MSIR). The Brayton Point ECC is being evaluated using benthic and acoustic surveys conducted in Summer 2021.

The benthic surveys were designed following the BOEM (2019) guidelines for conducting benthic habitat surveys and NMFS (2020) Recommendations for Mapping Fish Habitat. The first survey was conducted in Spring 2020 following a 1 to 2 km spacing along the ECC and a 1 to 2 km^2 spacing in the Lease Area. Benthic grab samples and SPI/PV samples were alternated. This provided a solid foundation of information as acoustic and geophysical surveys were being conducted simultaneously. For the Summer 2020 survey, the Spring data were evaluated and NMFS and BOEM and a strategy was imposed whereby SPI/PV was used at a higher density in areas of potentially complex habitat, augmented by benthic grab sampling. The density of benthic grab and SPI/PV sampling in the relatively homogenous habitats of the Lease Area and southern ECC was reduced. The strategy of each of the surveys and rationale for sampling locations have been provided to BOEM and NMFS, and the Field Sampling Plans have been appended to COP Appendix M.

The key observations from the Spring and Summer 2020 benthic surveys (COP Appendix M, Benthic and Shellfish Resources Characterization Report) were:

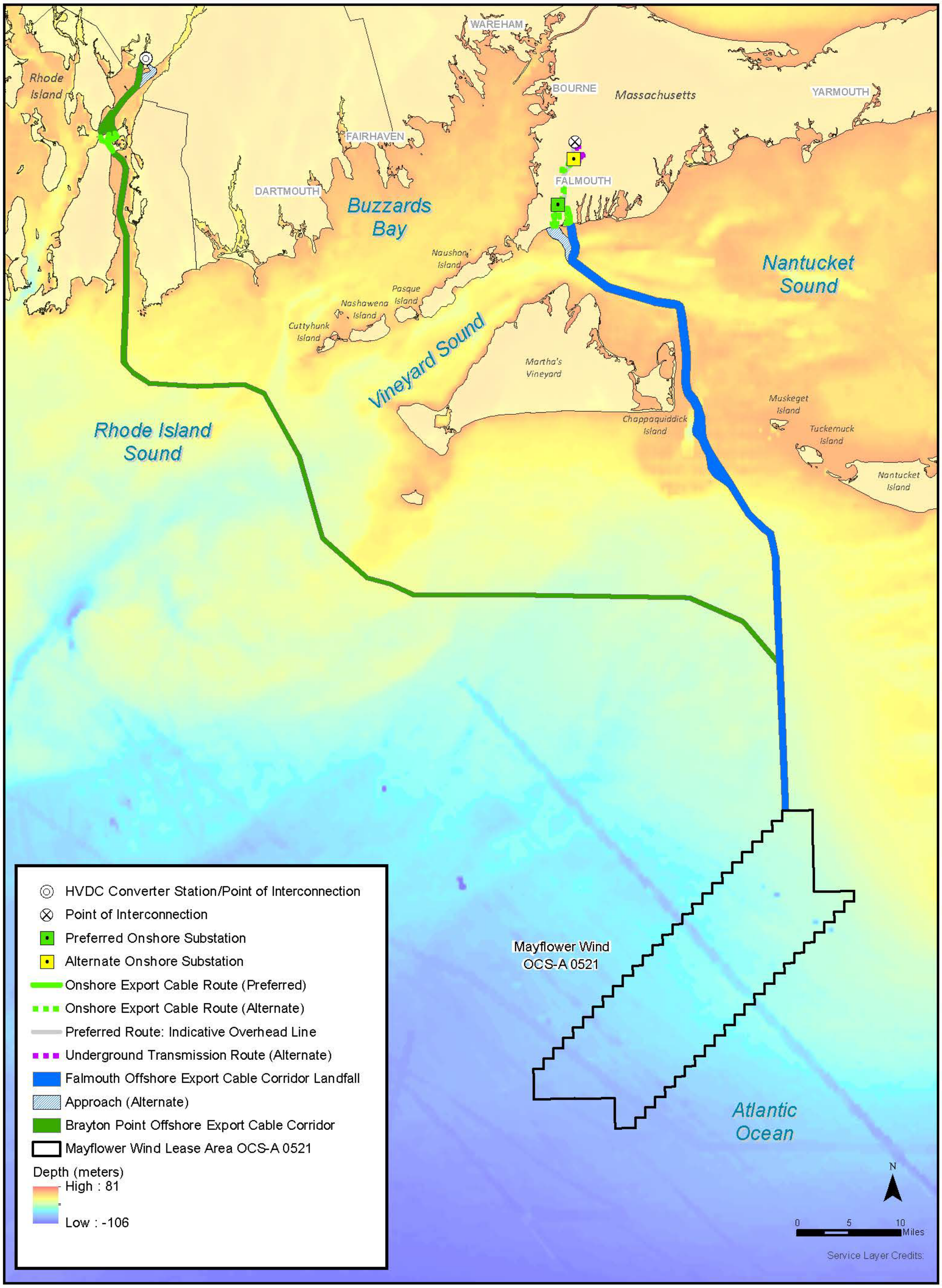
- The majority of the substrate in the northern Lease Area was homogeneous, dominated by Sand and Muddy Sand.
- The surficial substrate in the southern Lease Area was homogeneous with finer sediments (Sandy Mud and Mud) than that observed in the northern portion.
- The southern Falmouth ECC has homogenous bottom habitats, mostly comprised of Sandy Mud and Sand, similar to the northern Lease Area.
- The northern Falmouth ECC (inclusive of the Muskeget Channel) was heterogenous, with areas of complex habitat (NMFS, 2020) ranging from Gravel and Gravel Mixes to Sand and Muddy Sand with macroalgae noted at several locations.
- Control locations reflected the homogeneous habitat conditions (e.g., sand, mud) observed in the Lease Area and southern Falmouth ECC, based on substrate characterization.

The Sediment Plume Modeling (COP Appendix F1, Sediment Plume Impacts from Construction Activities) demonstrates varying levels of surface sediment mobility throughout the Lease Area and Falmouth ECC. This is indicated by the ubiquitous presence of bedforms (ripples) visible in the small-scale PV and grab camera images collected during the sampling campaigns. The seafloor in the offshore (i.e., Lease Area) is generally described as fine sand to silt (Figure 3-2). The deeper shelf waters of the Lease Area and Falmouth ECC are characterized by predominantly rippled sand and soft bottoms. It is anticipated that the portions of the Brayton Point ECC south of Rhode Island Sound are similar.

As the Falmouth ECC traverses the shoals and channels of the shallows in Muskeget Channel, surface sediment becomes coarser (sand with gravel) and hard bottoms (i.e., CMECS Substrate Group Gravels and Substrate Subgroup Gravel Pavement as defined by NMFS [2020]) are common. This coarser material represents reworked glacial sediment. These areas of Gravel Pavement are important for fish habitat, particularly juvenile cod habitat (NEFMC, 2017), and additional details including locations and representative images are provided in Attachment 1. A more complete description of the seafloor in the Offshore Project Area is provided in COP Appendix M, Benthic and Shellfish Resources Characterization Report and COP Appendix E, MSIR.

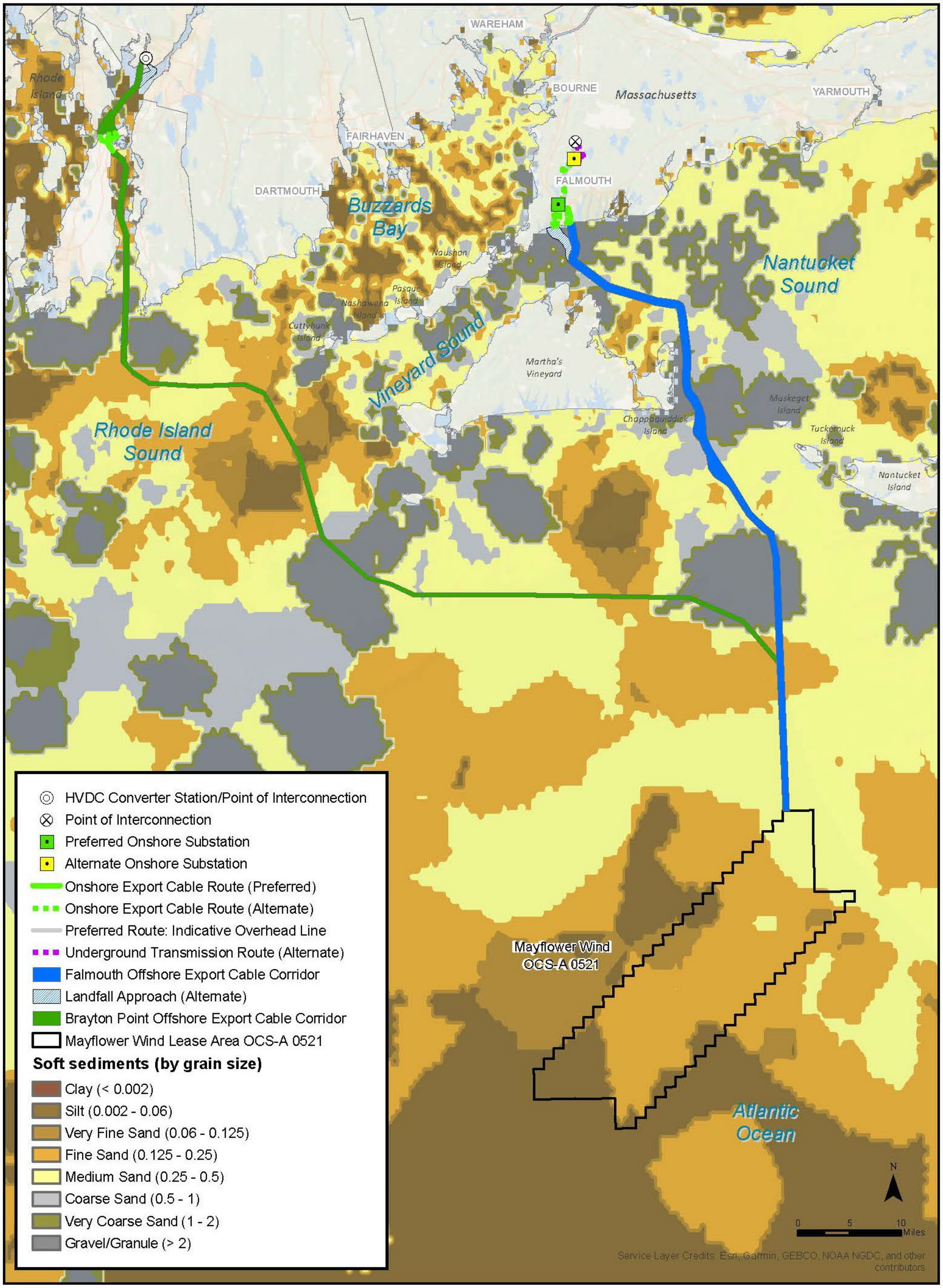
Additional surveys for the Brayton Point ECC including Mount Hope Bay and the Sakonnet River are ongoing. Based on publicly available data, similar conditions are expected along the majority of the Brayton Point ECC, with a large portion of the ECC crossing substrates consisting of fine to medium sand, and more isolated areas consisting of coarse sand to gravel. Data for the Sakonnet River and Mount Hope Bay portions of the Brayton Point ECC were limited in nature and will be investigated during the 2021 surveys.

Based on an initial review conducted by Fugro in preparation for the Summer 2021 benthic habitat survey and Brayton Point geophysical and acoustic survey, the Brayton Point ECC will cross through blocky, or boulder, and bounder/cobble/sand moraines mapped in the Rhode Island Ocean Special Area Management Plan (SAMP) area. Glacial moraines are broadly distributed within the Ocean SAMP area including off the western tip of Martha's Vineyard and Cuttyhunk Island. Seafloor features such as moraines will be mapped in more detail using acoustic data as part of the cable route planning process. These maps will define the limits and topography of the moraines in more detail and will be used to optimize the routing of cables within the Brayton Point ECC to reduce disturbance and protect the cables.



Source: ArcGIS Online, NOAA CRM

Figure 3-1. Offshore Project Area Bathymetry



Source: Interpolated data from USGS usSeabed: Atlantic coast offshore surficial sediment data (Data series 118, version 1.0); USGS East Coast Sediment Texture Database (2005), Woods Hole Coastal and Marine Science Center. (Anderson, et al., 2010)

Figure 3-2. Offshore Project Area Sediments

3.1.2 Benthic Habitat and Species

The softbottom substrates of the Offshore Project Area are habitat for common benthic soft sediment fauna such as clams, sand dollars, tube-building organisms such as *Ampelisca* species and surface burrowing species (e.g., Cossuridae and Paraonidae). In Nantucket Sound and the nearshore, the bottom conditions are generally coarse-grained, with gravels and granule substrates common. This substrate is more suitable habitat for Attached Fauna such as mollusks, bryozoa, and tunicates, and offers conditions suitable for complex habitat (as defined per NMFS, 2020). Figure 3-3 shows areas in the Offshore Project Area that Massachusetts Department of Marine Fisheries (MassDMF) identified as suitable shellfish habitat for commercial and recreational species. These habitats are in the immediate nearshore areas of Cape Cod, Martha's Vineyard and Nantucket, and in Muskeget Channel.

The data presented in the Benthic and Shellfish Resources Characterization Report (COP Appendix M) indicated a robust benthic community in the Offshore Project Area. In COP Appendix M, the Falmouth ECC has been classified as the Northern ECC and the Southern ECC due to differences in substrate, habitat and organism communities. Some of the original route options within the Northern ECC and Southern ECC have been down-selected, but the data are presented for completeness. The Western ECC option through Muskeget Channel, sampled in Fall 2020, includes a portion of the Falmouth ECC that has been retained, in the Project Design Envelope (PDE), but has not yet been classified into Northern ECC or Southern ECC. The average number of species and individuals per 0.43 ft^2 (0.04 m^2) collected in the three benthic surveys of 2020 are identified in the Table 3-1. As previously mentioned, additional surveys for the Brayton Point ECC are ongoing.

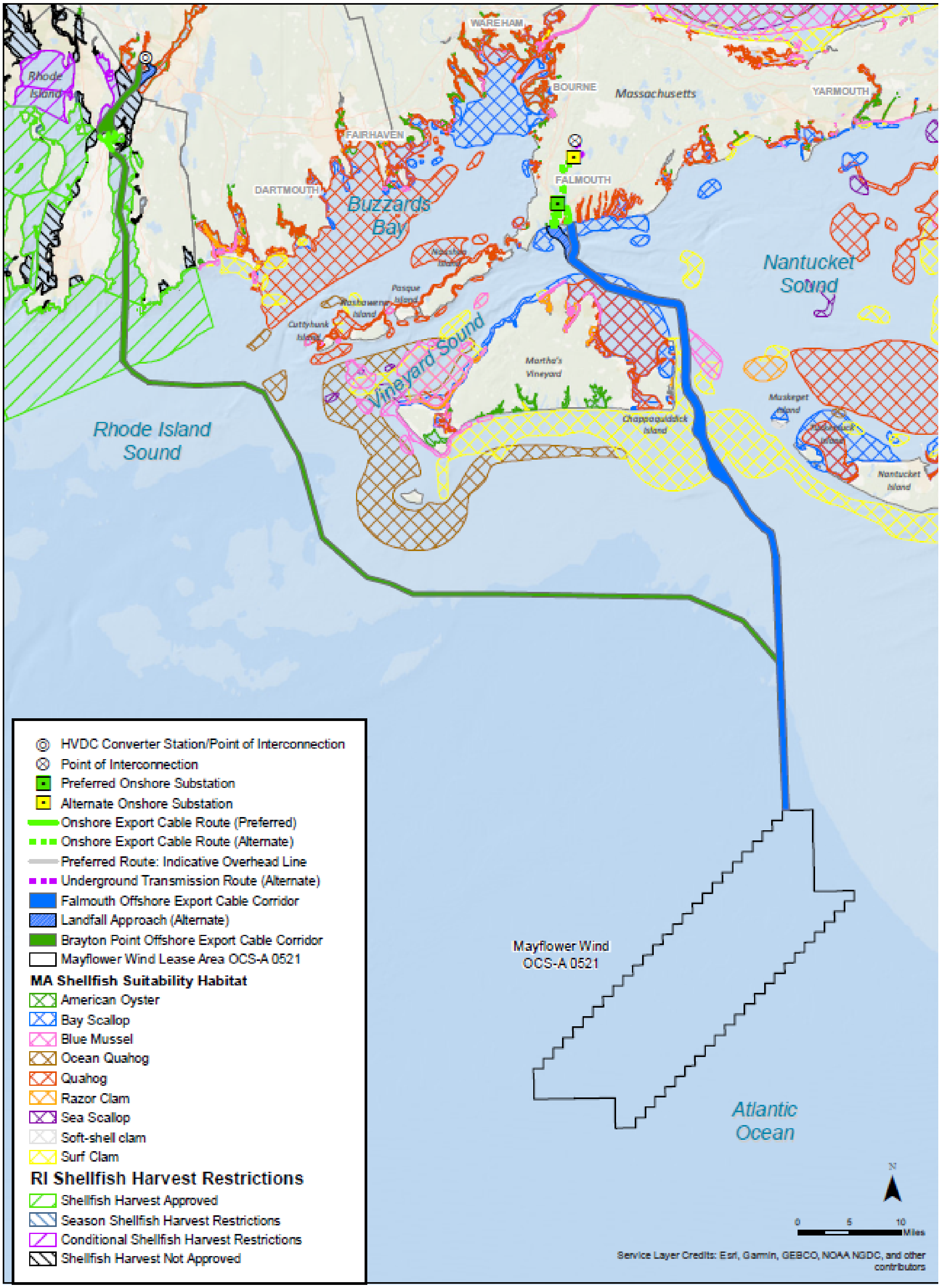
Table 3-1. Benthic Invertebrate Population in the Lease Area and Falmouth ECC – Spring/Summer 2020

Component	Average Number of Species*	Average Number of Individuals per 0.43 ft^2 (0.04m^2)
Spring Data		
Northern Export ECC	28	310
Southern ECC	20	1,349
Lease Area	34	1,005
Summer Data		
Northern ECC	21	252
Southern ECC	16	909
Lease Area	28	1,098
Fall Data		
Northern ECC	21	228
Western ECC	27	814
Southern ECC	19	622
Lease Area	31	1,375

**See COP Appendix M (Benthic and Shellfish Resources Characterization Report) for detailed list of benthic species.*

Primary conclusions from that report include:

- Benthic habitat type in the portion of the Falmouth ECC south of Muskeget Channel (Southern ECC) and in the Lease Area was classified using CMECS as Fine Unconsolidated material, dominated by sand. Complex habitat (Gravelly) was only observed at one location along the Southern ECC; no other complex habitat features were noted in the Southern ECC or in the Lease Area.
- Epifauna/megafauna found at the Southern ECC and Lease Area were predominantly surface-dwelling organisms (e.g., sand dollars, crabs, gastropods). Soft sediment fauna was the dominant CMECS subclass observed in the Southern ECC and Lease Area, characterized by tube-building and surface burrowing fauna.
- Several benthic substrates were identified that may be suitable habitat for various species of shellfish. Boulder and patchy cobble habitat are considered suitable and regionally important for the American lobster (Collie & King, 2016). Benthic substrates of sand with mobile gravel and sand sheet habitats are suitable for horseshoe crab, Atlantic surfclam, ocean quahog clam, channeled whelk, Atlantic rock crab, Jonah crab, and Atlantic sea scallop. Longfin squid are expected to be present in the Offshore Project Area seasonally. Longfin squid are demersal during the day and lay their eggs on the bottom substrate in patchy cobble and boulder on sand and sand with mobile gravelly habitats (Macy & Brodziak, 2001).



Source: MassDMF (2020)

Figure 3-3. Shellfish Suitability Areas

3.1.3 Submerged Aquatic Vegetation

The Seagrass and Macroalgae Report (COP Appendix K) includes a review of data from the state of Rhode Island and the Commonwealth of Massachusetts, data collected during a field survey of the Falmouth landfall locations in localized areas of known eelgrass beds, and images collected along the Falmouth ECC and in the Lease Area to support the benthic habitat characterization.

Primary conclusions from that report include:

- The eelgrass beds located near the Falmouth export cable landfall locations extend approximately 2,130 ft (650 m) at Mill Road, 1,970 ft (600 m) at Shore Street and 3,120 ft (950 m) at Worcester Avenue. Central Park, located adjacent to and west of Worcester Avenue, was not surveyed. However, the data from Worcester Avenue has adequate overlap and serves as a surrogate until final options are determined. The Mill Road landfall was surveyed but has since been eliminated from the Falmouth landfall locations under consideration in the PDE. The Mill Road and Shore Street eelgrass beds were almost continuous within the area surveyed. The eelgrass did not extend as far offshore on the western side of Mill Road, compared to the eastern side and Shore Street. At Worcester Avenue, the eelgrass was patchier than the other landfall locations, but the bed extended further offshore due to the shallower water depths.
- In the Lease Area and along the Southern ECC, no eelgrass was noted in the images collected from the benthic grab camera, or the SPI and PV image pairs.
- No eelgrass beds have been mapped by MassDEP or the state of Rhode Island along the Brayton Point ECC.

Through the Muskeget Channel to the Falmouth landfall locations (the Northern ECC [NECC]), macroalgae was identified in approximately two thirds of the locations. Macroalgae was observed from the underwater SPI/PV images and the grab camera images. Large mats of macroalgae were common at only one station in the Nantucket Sound Main Channel (Station 018), and a number of other locations had sparser amounts of macroalgae. The Brayton Point ECC is anticipated to have similar macroalgae abundance.

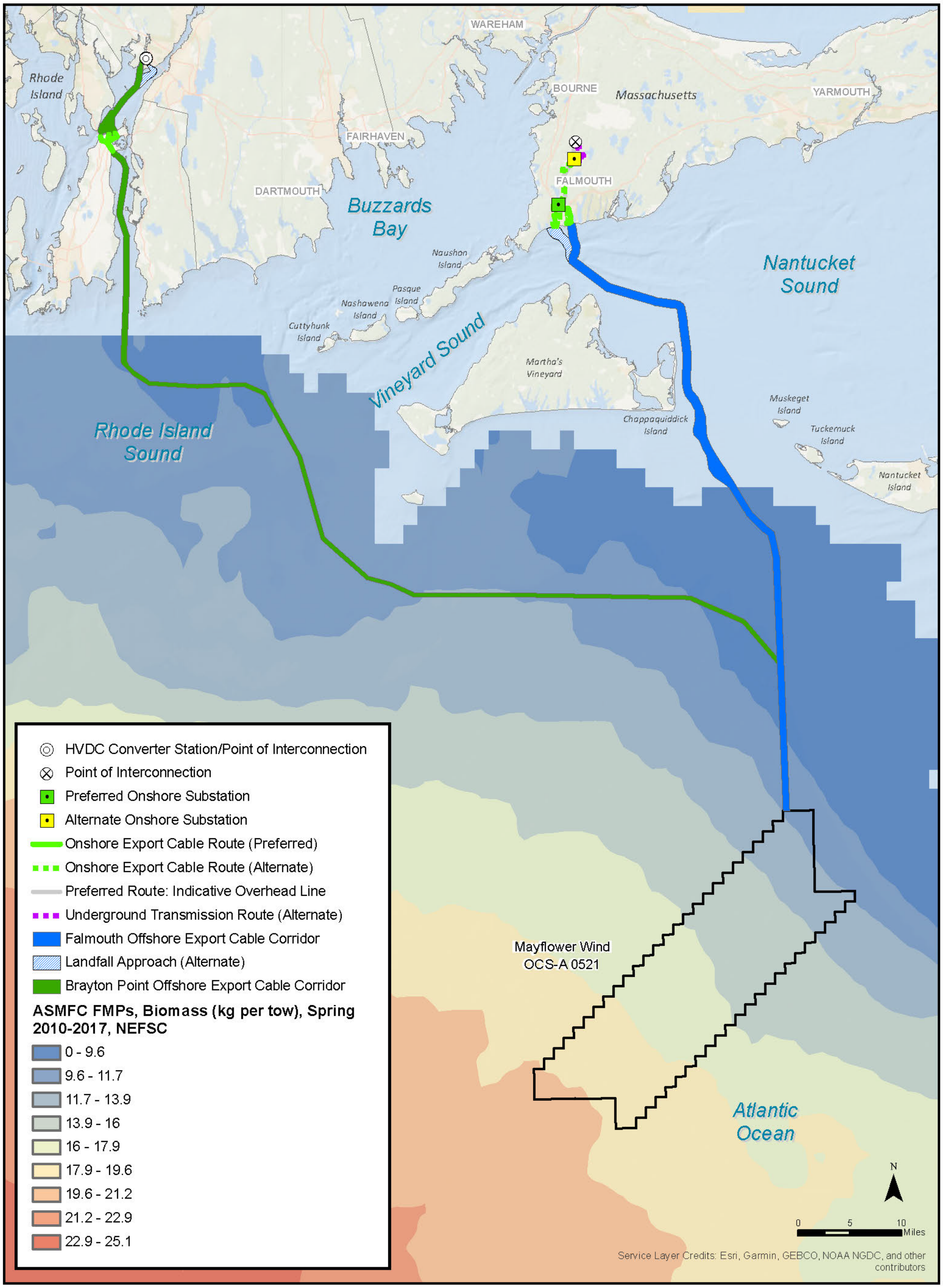
3.2 Fish

This section provides a brief description of the habitats of the Offshore Project Area (including the Lease Area and ECCs) in which fish live, a description of the types of fish present (including protected species), discussions on the physiological thresholds of finfish and a discussion of known mechanisms of effects from the operation of offshore wind installations on finfish populations. Unless otherwise noted, the Offshore Project Area refers to the Lease Area and both the Falmouth and Brayton Point ECCs.

The waters south of the Offshore Project Area support a diverse assemblage of fish species, which can vary throughout the year. During the winter months, when colder waters are present, the species assemblages are reduced. However, additional fish visit the area in the spring and summer months as the local waters warm.

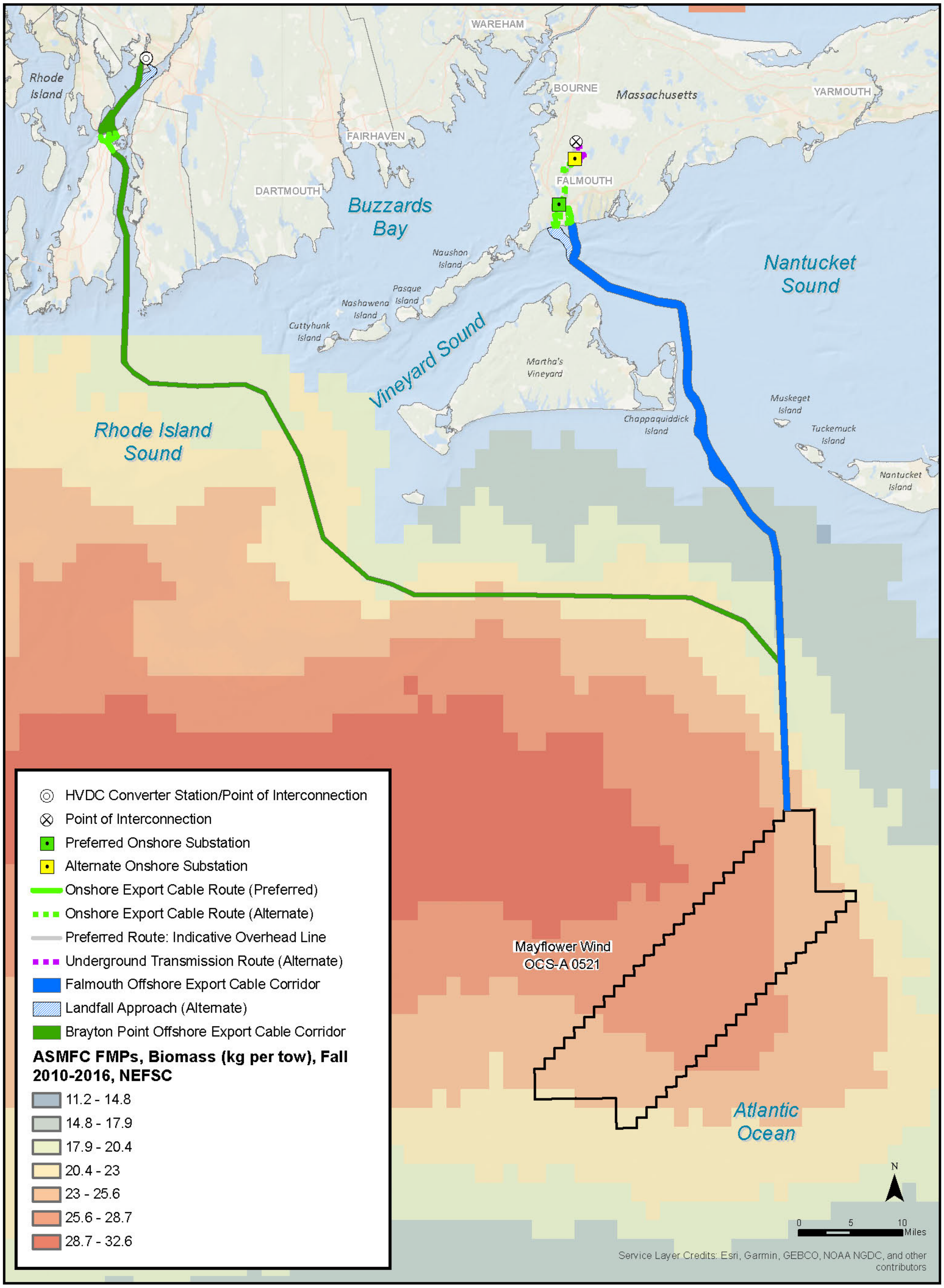
In 2017, BOEM prepared the Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts Revised Environmental Assessment. The document provided data on fauna within the Lease Area and neighboring lease areas. The combined lease areas were identified by BOEM as the Massachusetts/Rhode Island Wind Energy Area (MA/RI WEA). Habitat types and water depths are similar throughout the MA/RI WEA. Based on bottom trawl data conducted by the NMFS Northeast Fisheries Science Center (NEFSC), the MA/RI WEA has a lower biomass, but a higher species richness when compared to neighboring waters around Cape Cod (Figure 3-4 through Figure 3-7). The species richness provided in Figure 3-6 and Figure 3-7 represents the number of species from 2 km by 2 km interpolations (NEFSC, 2020). The high species richness may be due to fish species transiting from Long Island Sound and the bays of New England (e.g., Narragansett) that travel within or close to the MA/RI WEA, based on the increased number of species in the region where migration occurs.

Important pelagic finfish with ranges that overlap the Offshore Project Area include forage species such as Atlantic herring (*Clupea harengus*) and Atlantic mackerel (*Scomber scombrus*) and predatory fish such as yellowfin tuna (*Thunnus albacares*) and albacore tuna (*Thunnus alalunga*) (Epsilon Associates Inc., 2020).



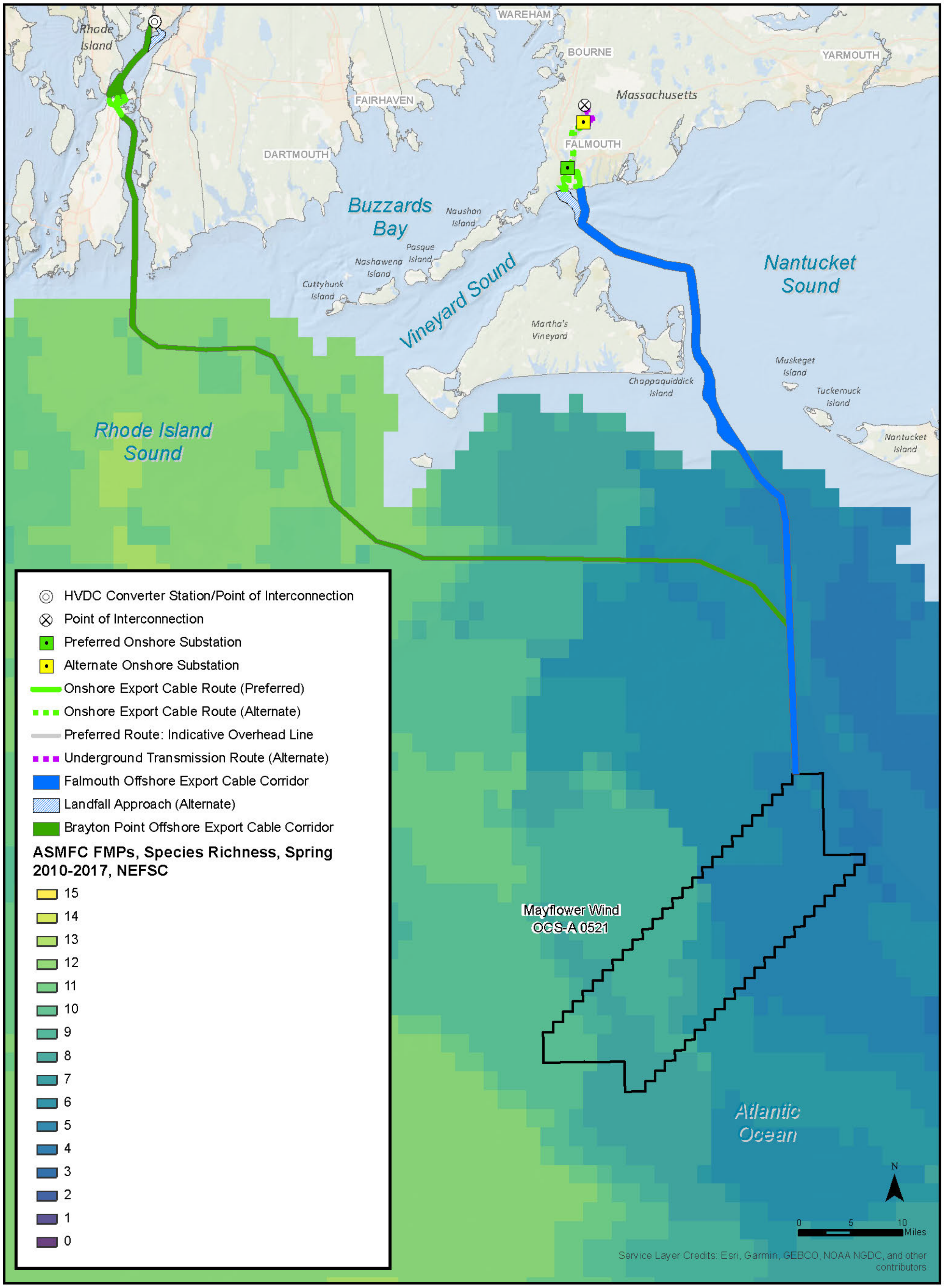
Source: NEFSC (2020)

Figure 3-4. Total Biomass of Fish Caught During the NEFSC Spring Bottom Trawl Survey (2010- 2017)



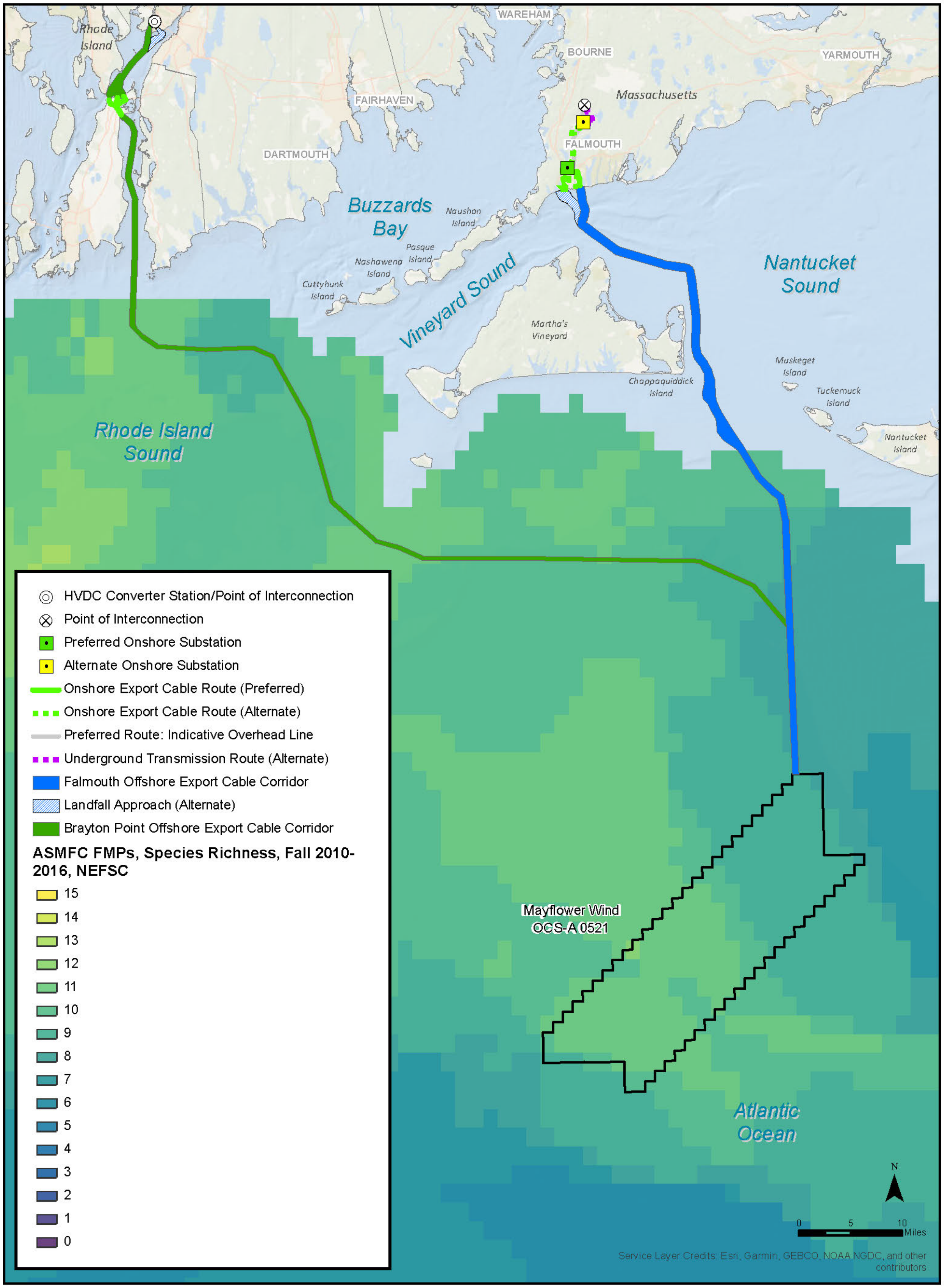
Source: NEFSC (2020)

Figure 3-5. Total Biomass of Fish Caught During the NEFSC Fall Bottom Trawl Survey (2010- 2016)



Source: NEFSC (2020)

Figure 3-6. Species Richness (Number of Vertebrate Species of Fish) Caught During the NEFSC Spring Bottom Trawl Survey (2010-2017)



Source: NEFSC (2020)

Figure 3-7. Species Richness (Number of Vertebrate Species) of Fish Caught During the NEFSC Fall Bottom Trawl Survey (2010-2016)

3.3 Protected Fish Species

The NOAA Fisheries Endangered Species Act Mapper (NOAA Fisheries, 2020) was consulted to determine what federally threatened or endangered fish species may be present in the Offshore Project Area. The mapper indicated two protected species, Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*A. brevirostrum*), may be present. Additional information regarding each of these species is provided in the sections below.

3.3.1 Atlantic Sturgeon

The Atlantic sturgeon is a state and federally listed endangered species (NOAA, 2020; Massachusetts Division of Fish and Wildlife [MA DFW], 2015a). The Atlantic sturgeon is a large sturgeon that spends most of its life in salt and brackish waters and returns to freshwater periodically to spawn (Atlantic States Marine Fisheries Commission [ASMFC], 2017). Atlantic sturgeon ranges from Newfoundland to the Gulf of Mexico and are highly migratory. The species is slow-growing and late-maturing and has been recorded to reach up to 14 ft (4.3 m) in length, weigh up to 800 pounds (lb) (363 kilograms [kg]), and live up to 60 years of age (NOAA, 2020; Sulak et al., 2002). Atlantic sturgeon are bottom feeders, with a diet often consisting of invertebrates (e.g., crustaceans, worms), mollusks, and bottom-dwelling fish (NOAA, 2020).

This anadromous species spends much of its life in estuarine and marine waters throughout the Atlantic Coast. Adults spawn in fresh water in the spring and early summer and migrate into estuarine and marine waters. Eggs are deposited on hard-bottom substrate (e.g., cobble, coarse sand, and bedrock) (Greene et al., 2009). After hatching, the developing larvae move downstream to the estuarine portion of the spawning river, where they reside as juveniles for years. Sub-adults and adults travel within the marine environment, typically in waters less than 164 ft (50 m) in depth, using coastal bays, sounds, and ocean waters.

Atlantic sturgeon could be present in the Offshore Project Area throughout the year because both the depths and substrates are within their preferred habitats. This species would likely be most prevalent in the Offshore Project Area during the warmer months of the year as the fish would potentially swim through the Offshore Project Area to enter various coastal rivers and streams for spawning.

3.3.2 Shortnose Sturgeon

The shortnose sturgeon is a state listed endangered and federally listed endangered (New York Bight Distinct Population Segment) and threatened (Gulf of Maine Distinct Population Segment) species (NOAA, 2020; MADFW, 2015b). It is an anadromous species found mainly in large freshwater rivers and coastal estuaries on the east coast of North America from New Brunswick to Florida.

Shortnose sturgeon require freshwater for spawning (salinity limit of about 0.5 parts per thousand [ppt]). They spawn at or above the head-of-tide (the farthest point upstream affected by tidal fluctuations) in most rivers to which mature adults migrate in spring. After hatching, the young-of-year (YOY) remain in freshwater for about one year before moving downstream to the zone where fresh and salt water interface. Juveniles (3 to 10 years of age) occur at the fresh-saline water interface in most rivers, where they shift slightly upstream in spring and summer and downstream in fall and winter. Adults are generally found upstream while spawning in the spring and spend the remainder of the year at the fresh and saltwater interface. In estuarine systems, juveniles and adults occupy areas with little or no current over a bottom composed primarily of mud and sand (SSSRT, 2010). Individual shortnose sturgeon do not disperse far along the coastline beyond their home river estuaries (NMFS, 1998). Because of its preference for mainland rivers and fresh and estuarine waters, shortnose sturgeon are unlikely to be found in the vicinity of the Offshore Project Area. However, shortnose sturgeon may be found along the Brayton Point ECC within the Sakonnet River, Mount Hope Bay and the adjacent Lee River.

3.4 Key Physiological Tolerances of Fish

The potential for effects to marine fauna from the Project are addressed in Section 5.0, including effects of water quality/turbidity, hydro acoustics, electromagnetic field (EMF) exposure, and habitat alteration. This subsection identifies the physiological thresholds of fish on which effects are based.

3.4.1 Turbidity

Respiration is a key life function for fish. All fish breathe by forcing water over their gills. As the water passes over the gills, dissolved oxygen is absorbed into the fish's blood and travels to cells within a fish's body. Increased sediment resuspension can affect fish respiration and other functions, such as feeding. Common turbidity effects on fish are abrasion of gill membranes resulting in the inability to collect oxygen, impairment of feeding, reduction in available dissolved oxygen, and fatality in early life stages. However, sensitivity to turbidity from resuspended sediments differs substantially amongst species, life stages, duration, magnitude, and the availability of nearby, less turbid waters to which fish may relocate.

Total suspended solids concentration (TSS), a gravimetric measure of particles in suspension generally measured as milligrams per liter (mg/L), is used as a measure of turbidity to evaluate water quality effects. Table 3-2 below identifies certain species and known deleterious levels of TSS on certain fish and shellfish life stages based a study by Morgan et al. (1983) and a review by Wilbur and Clarke (2001). Table 3-3 identifies general sensitivity levels of fish eggs and larvae for species common to estuarine and nearshore marine environments based on Wilbur and Clarke (2001). The results of sediment transport modeling are presented in a separate report (COP Appendix F1, Sediment Plume Impacts from Construction Activities) and are not detailed within this report.

Table 3-2. Suspended Solids Tolerances of Larvae and Eggs

Impact	Value
Larval Fish – mortality	1,300 mg/L (citation [1])
Larval striped bass – lower feeding rates	200-500 mg/L (citation [2])
Striped bass (delay of egg hatching)	800 mg/L (citation [2])
White perch (delay of egg hatching)	100 mg/L (citation [2])
Quahog egg development	1,000 mg/L (citation [2])
Oyster egg development	188 mg/L (citation [2])

Table 3-3. Species-Specific Sensitivity to Suspended Solids for Larval Fish and Eggs

Sensitivity Level	24-hour Lethal Concentration to 10% of Organisms (LC10)	Species
Tolerant	>10,000 mg/L	mummichog, striped killifish, spot, oyster toadfish, hogchoker, and cusk eel
Sensitive	1,000 to 10,000 mg/L	white perch, bay anchovy, juvenile Atlantic menhaden, striped bass, Atlantic croaker, and weakfish
Highly Sensitive	< 1,000 mg/L	Atlantic silversides, juvenile bluefish, and age-0 white perch

Source: Wilbur and Clarke (2001); LC10 = lethal concentration 10% (the concentration at which 10% of the individuals will die)

[1] Morgan et al. (1983)
[2] Wilbur and Clarke (2001)

3.4.2 Acoustic Thresholds and Underwater Sound

3.4.2.1 Fish Hearing

Many fish rely on sound (hearing) to sense both predators and prey, navigate, socialize, attract mates, and for other functions. Human-caused noise can interfere with these functions.

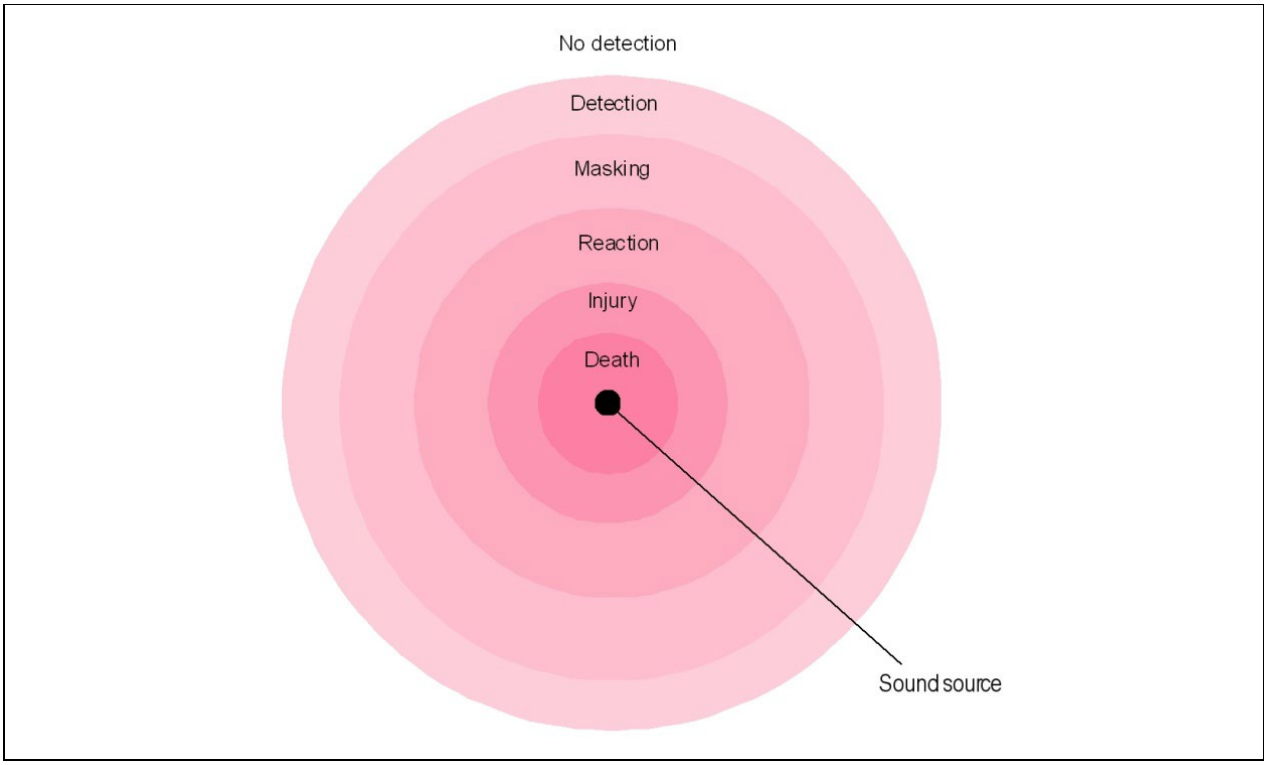
The marked difference in density between air and water affects the propogation of sound in each medium. While sound moves at a much faster speed in the water than in air, the distance that sound waves travel is primarily dependent upon ocean temperature and pressure (National Ocean Service, 2021). Sound also attenuates much less rapidly in waters. Although sound assists fish with critical life functions, loud or persistent underwater noise can cause injury or death for marine life. Barotrauma may occur if sound waves are generated at levels high enough to damage fish tissues, which may lead to instant or rapid mortality or injure a fish in such a manner (e.g., loss of hearing) that would reduce the fish's ability to avoid predation. Additionally, an increase in localized noise may alter a fish's behavior causing further perturbations (FHWG, 2008 and Stadler and Woodbury, 2009, as cited in NOAA Fisheries GARFO, 2020).

The auditory portions of fish ears are the otolithic organs that respond to particle motion of the surrounding fluid (Popper et al., 2014). Many fishes are also able to detect sound pressure via the gas bladder or other gas-filled structures that re-radiate energy, in the form of particle motion, to the otolithic organs. The adaptations that provide fish with a sensitivity to sound pressure are gas-filled structures near the ear and/or extensions of the swim bladder that functionally affect the ear. Fishes with these adaptations generally have lower sound pressure thresholds and wider frequency ranges of hearing than do the purely particle motion sensitive species (Popper et al., 2014).

Most bony fishes have a swim bladder that is used for buoyancy control and may also be used for hearing, sound production, and/or respiration. Fish species with a swim bladder and other gas chambers have a greater potential to suffer from physiological trauma (barotrauma) than those without gas chambers due to sudden pressure changes. Fish species lacking a gas-filled cavity primarily detect particle motion and do not detect sound pressure. Some fish species have a functional physical connection between the swim bladder, or some other gas chamber, and the inner ear and their hearing depends much more upon sound pressure.

Flatfish including Winter Flounder and other elasmobranchs (e.g., rays, skates, and sharks) do not have swim bladders. As such, they are least susceptible to sound. Fishes whose swim bladders do not extend to the inner ear, including tuna and salmon, also have relatively poor ability to sense noise. Teleosts, including commercially important species such as butterflyfish, Atlantic cod and Atlantic herring, are among the most sensitive fish to sound, and the swim bladder or gas-filled duct is located adjacent to the inner ear.

Richardson et al. (1995) defined zones from a receptor around a sound source that could result in different types of effects on aquatic animals (Figure 3-8). Broadly, if a fish is in very close proximity to the sound source (e.g., pile driving), the sound (pressure) may result in instant mortality or serious injury. However, when a fish is farther from the sound source, the sound attenuates and there is less of a chance of injury or behavioral reaction. In actuality, these effects will vary based on a number of factors such as hearing sensitivity, source level, physiological composition of an individual species, noise propagation characteristics in a particular location, etc.



Note that these zones are overlapping. Thus, in the "injury" zone one may also include other effects encountered at greater distances, such as reaction, masking, etc. The distance of each zone around a source depends on many factors, but most importantly on the sound level of the source. (Adapted by A. Hawkins from Richardson et al., 1995)

Figure 3-8. Acoustic Injury Zones

3.4.2.2 Accoustic Thresholds

Sound level threshold or criteria are based on measurements of Peak, cumulative sound exposure level (cSEL), and root square mean (RMS), as defined by NOAA GARFO (2020) and described as follows:

- Peak sound pressure level: the largest absolute value of the instantaneous sound pressure expressed in decibels (dB) referenced to (re) 1 micro Pascal (μPa) (dB re 1 μPa) in water;
- cSEL: the energy accumulated over multiple strikes or continuous vibration over a period of time. The cSEL value is not a measure of the instantaneous or maximum noise; and
- RMS: the square root of the average squared pressures over the duration of a pulse; most pile-driving impulses occur over a 50 to 100 millisecond (msec) period, with most of the energy contained in the first 30 to 50 msec (Illingworth & Rodkin, Inc. 2001; Oestman et al., 2009).

Thus, Peak, cSEL, and RMS represent the decibel level where instantaneous injury, cumulative injury, or behavioral changes would likeky occur. For instance, if sound was measured at above 187 dB at 33 ft (10 m) from the source and a sturgeon was within 10 ft (3 m) of the source, the sturgeon could suffer instant mortality by being within an an area ensonified at a level greater than its physiological threshold. Conversely, if sound was measured below 150 dB re 1 μPa RMS at a distance of 328 ft (100 m) from the source, sturgeon at this distance or greater from the pile would likely have no behavioral effects as the area they are occupying is ensonified at a level below their threshold for behavioral effects.

To address potential effects from underwater noise, NOAA Fisheries has implemented the following sound level thresholds for sturgeon (NOAA GARFO, 2020):

- 206 dB re 1 μPa Peak (peak injury);
- 187 dB re 1 μPa^{2}s cSEL (cumulative injury for fish > 2 grams);
- 183 dB re 1 μPa^{2}s cSEL (cumulative injury for fish < 2 grams); and
- 150 dB dB re 1 μPA RMS (behavioral).

Guidelines for the potential effects on fish for underwater sounds from impact pile-driving were also developed by an international group of experts under the auspices of the American National Standards Institute (ANSI) (Popper et al., 2014). Sound thresholds were grouped into fishes without swim bladders, fishes with a swim bladder not involved in hearing, and fishes with a swim bladder involved in hearing and are provided in Table 3-4. There are no ANSI thresholds for hearing based on particle motion.

Table 3-4. Maximum Range to Fish Sound Thresholds from Impact Pile-Driving

Sound Level	Onset of Mortality	Onset of Injury	TTS
Fishes without a swim bladder			
SEL_{cum}	>219	>216	>186
SPL_{peak}	>213	>213	
Fishes with a swim bladder not involved in hearing			
SEL_{cum}	210	203	>186
SPL_{peak}	>207	>207	
Fishes with a swim bladder involved in hearing			
SEL_{cum}	207	203	>186
SPL_{peak}	>207	>207	

Notes:

SEL_{cum} = Cumulative sound exposure level (decibel referenced to 1 microPascal squared seconds [dB re 1 μPa^2-s])

SPL_{peak} = Peak sound pressure level (decibel referenced to 1 microPascal [dB re 1 μPa])

“>” indicates that the given effect would occur above the reported threshold

TTS = Temporary Threshold Shift; “>” indicates that the given effect would occur above the reported threshold.

Source: Popper et al. 2014f

3.4.2.3 Electric and Magnetic Fields

EMF would be generated by the inter-array cables connecting the WTGs in the Lease Area and from export cables along the ECCs. There is limited research on the effects of EMFs on fish. Some cartilaginous fish, such as sharks, skates, rays, and to a lesser extent some bony fish (e.g., American eel, Atlantic salmon, and Atlantic yellowfin tuna), sense electromagnetic fields and may use it to locate prey (BOEM, 2020c).

Pelagic fish such as striped bass, bluefish, weakfish, and Atlantic mackerel have habitat preferences above the seafloor and would be away from the EMF field. Bottom-dwelling fish, such as sturgeon and skates, are most likely to encounter EMF from undersea power cables located on the sea floor that are associated with offshore wind energy projects. Skates (Family Rajidae) have the greatest potential effects from EMF from undersea power cables because they combine electro-sensitivity with a bottom-dwelling life history (BOEM, 2020c). Hutchinson et al. (2020) found that the little skate showed an increase in exploratory/foraging behavior when exposed to anthropogenic EMF. However, at present there is limited evidence that fish are influenced by the electric and magnetic fields that underwater cables from WTGs generate (Öhman et al., 2007).

Elasmobranch species are present seasonally in the Offshore Project Area; however, their abundance varies annually and is relatively low (Northeast Regional Ocean Council, 2020). Detailed information regarding EMF levels is provided in COP Appendix P1, Electric and Magnetic Field (EMF) Assessment for the Proposed Mayflower Wind Submarine Export Cables.

3.4.3 Structure Placement and Habitat Creation

Hard substrates (e.g., reefs, stones, outcrops) onto which sessile organisms or flora can attach are often a limiting habitat in the marine environment. Reefs and submerged structures of geological or biogeological origin support a variety of marine flora and fauna in sublittoral and littoral zones around the world. In addition, structures are sometimes purposefully placed to encourage the development of reef habitat, creating “artificial reefs.”

The placement of structures in the water (e.g., monopiles for WTGs, concrete mattresses, scour protection) will eventually become artificial reefs. Some areas of sandy, low expanse relief will be lost when structures are placed in the water. However, there is similar sandy habitat located adjacent to the placement areas where mobile species can move. As soon as WTG/OSP foundations are installed the colonization of microbes initiates and is quickly followed by larger animals (Hammar et al., 2016). With time, filter-feeding animals tend to dominate the vertical structures while the base of the foundations and the score protections are typically colonized by crabs and starfish (Hammar et al., 2016; Horwath, et al., 2020). The community is initially dominated by invertebrates, but over time more complex communities form when fish are attracted to the increase in available prey on and near the structures that function as artificial reefs and provide shelter and a reprieve from the currents.

The area and volume of the reef, the reef height and profile, the complexity, the composition of the reef material and its location all influence the reef carrying capacity and its effectiveness as a suitable habitat (Bohnsack & Sutherland, 1985; Pickering & Whitmarsh, 1997). In contrast to most natural and artificial reef communities that are limited to reef structures on the seabed, WTG/OSP foundations extend throughout the water column, resulting an increase in species diversity from the seabed to the surface (English et al., 2017).

4.0 Essential Fish Habitat

4.1 Regulatory Background and Requirements

The Fishery Conservation and Management Act of 1976, later changed to the Magnuson Fishery Conservation and Management Act in 1980, established a 200-nm fishery conservation zone in United States (U.S.) waters and a regional network of FMCs. The FMCs are composed of federal and state officials, including the United States Fish and Wildlife Service (USFWS), which oversees fishing activities within the fishery management zone. In 1996, the Magnuson Fishery Conservation and Management Act was reauthorized and amended as the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (16 U.S. Code [USC] 1801-1882), also known as the Sustainable Fisheries Act. The MSFCMA mandated numerous changes to the existing legislation designed to prevent overfishing, rebuild depleted fish stocks, minimize bycatch, enhance research, improve monitoring, and protect fish habitat.

One of the most significant mandates in the MSFCMA is the EFH provision, which provides the means to conserve fish habitat. The EFH mandate requires that the regional FMCs, through federal Fishery Management Plans (FMPs), describe and identify EFH for each federally-managed species, minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitats.

Congress defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802[10]). The term "fish" is defined in the MSFCMA as "finfish, mollusks, crustaceans, and all other forms of marine animals and plant life other than marine mammals and birds." NMFS further clarified the terms associated with EFH (50 CFR 600.05-600.930) by the following definitions:

- Waters – Aquatic areas and their associated physical, chemical, and biological properties that are used by fish and, where appropriate, may include aquatic areas historically used by fish;
- Substrate – Sediments, hard bottoms, structures underlying the waters, and associated biological communities;
- Necessary – The habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and
- Spawning, breeding, feeding, or growth to maturity – Stages representing a species' full life cycle.

The regulations for implementing EFH clarify that "waters" include all aquatic areas and their biological, chemical, and physical properties, while "substrate" includes the associated biological communities that make these areas suitable fish habitats.

Habitats used at any time during a species' life cycle (i.e., during at least one of its life stages) must be accounted for when describing and identifying EFH. In addition to EFH designations, HAPCs, which are a subset of designated EFH that is especially important ecologically to a species/life stage and/or is vulnerable to degradation, are also to be designated to provide additional focus for conservation efforts. Categorization as HAPC does not confer additional protection or restriction to designated areas.

Authority to implement the MSFCMA is given to the Secretary of Commerce and delegated to NOAA Fisheries. The MSFCMA requires that EFH are identified and described for each federally-managed species. NOAA Fisheries and regional FMCs determine the species distributions by life stage and characterize associated habitats, including HAPC. The MSFCMA requires federal agencies to consult with NOAA Fisheries on activities that may adversely affect EFH, or when NOAA Fisheries independently learns of a federal activity that may adversely affect EFH. The MSFCMA defines an adverse effect as "any impact which reduces quality and/or quantity of EFH [and] may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey or reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions" (50 CFR 600.810).

Species and life stages with designated EFH in the Lease Area and eight component areas (defined in Section 2.1) are presented in Section 4.3. HAPCs play important roles in the life history (e.g., spawning areas) of federally managed fish species or are especially vulnerable to degradation from fishing or other human activities. In the Offshore Project Area there is HAPC, for juvenile cod, as discussed in Section 4.3.1.3. Summer flounder HAPC, discussed in Section 4.3.1.18, is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. Where native species have been eliminated, exotic species are included as HAPC.

4.2 EFH Designations at Each Project Component

To delineate EFH, coastal littoral and continental shelf waters were first mapped by the regional Fisheries Management Councils and then superimposed with 10-minute[3] square grids. Then, survey data, gray literature, peer-reviewed literature, and reviews by academic and government fisheries experts were all used by the FMCs to determine if these 10-minute square grids support EFH for federally managed species.

Review of NOAA Fisheries' Essential Fish Habitat Mapper determined that the Project is located within twenty-four 10-minute square grids (NOAA Habitat Conservation, 2020). Using the species and life stage designations of the grid squares that cover the Lease Area, ECCs, and approach/landfall component areas, 46 species of finfish and invertebrates have designated EFH for various life stages within the Offshore Project Area. The Offshore Project Area with 10-minute square grids is presented in Figure 4-1. These species are listed in Table 4-1 for finfish and Table 4-2 for skates, invertebrates, and highly migratory species (NOAA Habitat Conservation, 2020). Full descriptions of each of these species and life stages are provided in Section 4.3.

[3] A minute of arc is a unit of measurement equal to 1/60 of a degree. The nm was originally defined as 1 minute of latitude on a hypothetical spherical earth.

Table 4-1. EFH Designations for Finfish Species in the Lease Area, Landfalls, and Export Cable Corridors

Species and Life Stages	Presence at Each Project Component								
	Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
New England Finfish Species									
American plaice (*Hippoglossoides platessoides*)									
Eggs									
Larvae	X								
Juvenile									
Adult									
Atlantic butterfish (*Peprilus triacanthus*)									
Eggs	X	X			X	X	X	X	X
Larvae	X	X			X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Atlantic cod (*Gladus morhua*)									
Eggs	X	X	X	X	X	X	X	X	X
Larvae	X	X	X	X	X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X			X	X			
Atlantic herring (*Clupea harengus*)									
Eggs	X	X							
Larvae	X	X			X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X			X	X	X	X	X
Atlantic mackerel (*Scomber scombrus*)									
Eggs	X	X			X	X	X	X	X
Larvae	X	X			X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X

	Presence at Each Project Component								
Species and Life Stages	**Lease Area**	**Falmouth ECC**	**Worcester Avenue/ Central Park Landfalls**	**Shore Street Landfall**	**Brayton Point offshore ECC**	**Sakonnet River ECC**	**Mount Hope Bay ECC**	**Aquidneck Island Landfalls**	**Brayton Point Landfalls**
Adult	X					X	X	X	X
Atlantic wolffish (*Anarhichas lupus*)									
Eggs		X	X	X	X				
Larvae		X	X	X	X				
Juvenile		X	X	X	X				
Adult		X	X	X	X				
Black sea bass (*Centropristis striata*)									
Eggs									
Larvae									
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Bluefish (*Pomatomus saltatrix*)									
Eggs									
Larvae									
Juvenile					X	X	X	X	X
Adult	X	X			X	X	X	X	X
Haddock (*Melanogrammus aeglefinus*)									
Eggs	X	X			X				
Larvae	X	X			X				
Juvenile	X								
Adult	X								
Monkfish (*Lophius americanus*)									
Eggs	X	X			X				
Larvae	X	X			X				
Juvenile	X				X				
Adult	X				X				

Species and Life Stages	Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
	Presence at Each Project Component								
Ocean pout (*Macrozoarces americanus*)									
Eggs	X	X			X	X	X	X	
Juvenile	X	X			X				
Adult	X	X			X				
Offshore hake (*Merluccius albidus*)									
Eggs									
Larvae	X	X							
Juvenile									
Adult									
Pollock (*Pollachius and P. virens*)									
Eggs	X				X				
Larvae	X	X			X				
Juvenile	X				X	X	X	X	X
Adult									
Red hake (*Urophycis chuss*)									
Eggs	X	X			X	X	X	X	X
Larvae	X	X			X	X	X	X	X
Juvenile	X	X			X	X	X	X	X
Adult	X	X			X	X	X	X	X
Scup (*Stenotomus chrysops*)									
Eggs						X	X	X	X
Larvae						X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Silver hake (*Merluccius bilinearies*)									
Eggs	X	X			X	X	X	X	X

	Presence at Each Project Component								
Species and Life Stages	**Lease Area**	**Falmouth ECC**	**Worcester Avenue/ Central Park Landfalls**	**Shore Street Landfall**	**Brayton Point offshore ECC**	**Sakonnet River ECC**	**Mount Hope Bay ECC**	**Aquidneck Island Landfalls**	**Brayton Point Landfalls**
Larvae	X	X			X	X	X	X	X
Juvenile	X	X							
Adult	X	X			X	X	X	X	
Spiny dogfish (*Squalus acanthias*)									
Juvenile	X								
Sub-Adult Male	X	X			X				
Sub-Adult Female	X	X			X				
Adult Male	X	X			X				
Adult Female	X	X			X				
Summer Flounder (*Paralichthys dentatus*)									
Eggs	X	X	X	X	X	X	X	X	X
Larvae	X	X	X	X	X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
White hake (*Urophycis tenuis*)									
Eggs									
Larvae		X			X				
Juvenile	X	X			X				
Adult	X								
Windowpane flounder (*Scophthalmus aquosus*)									
Eggs	X	X			X	X	X	X	X
Larvae	X	X			X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Winter Flounder (*Pseudopleuronectes americanus*)									
Eggs		X	X	X	X	X	X	X	X

Species and Life Stages	Presence at Each Project Component								
	Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
Larvae	X	X	X	X	X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Witch flounder (*Glyptocephalus cynoglossus*)									
Eggs	X				X				
Larvae	X	X			X				
Juvenile	X								
Adult	X	X							
Yellowtail flounder (*Limanda ferruginea*)									
Eggs	X	X			X				
Larvae	X	X			X				
Juvenile	X	X			X				
Adult	X	X			X				

Table 4-2. EFH Designations for Skates, Invertebrates and Highly Migratory Species in the Lease Area, Landfalls, and Export Cable Corridors

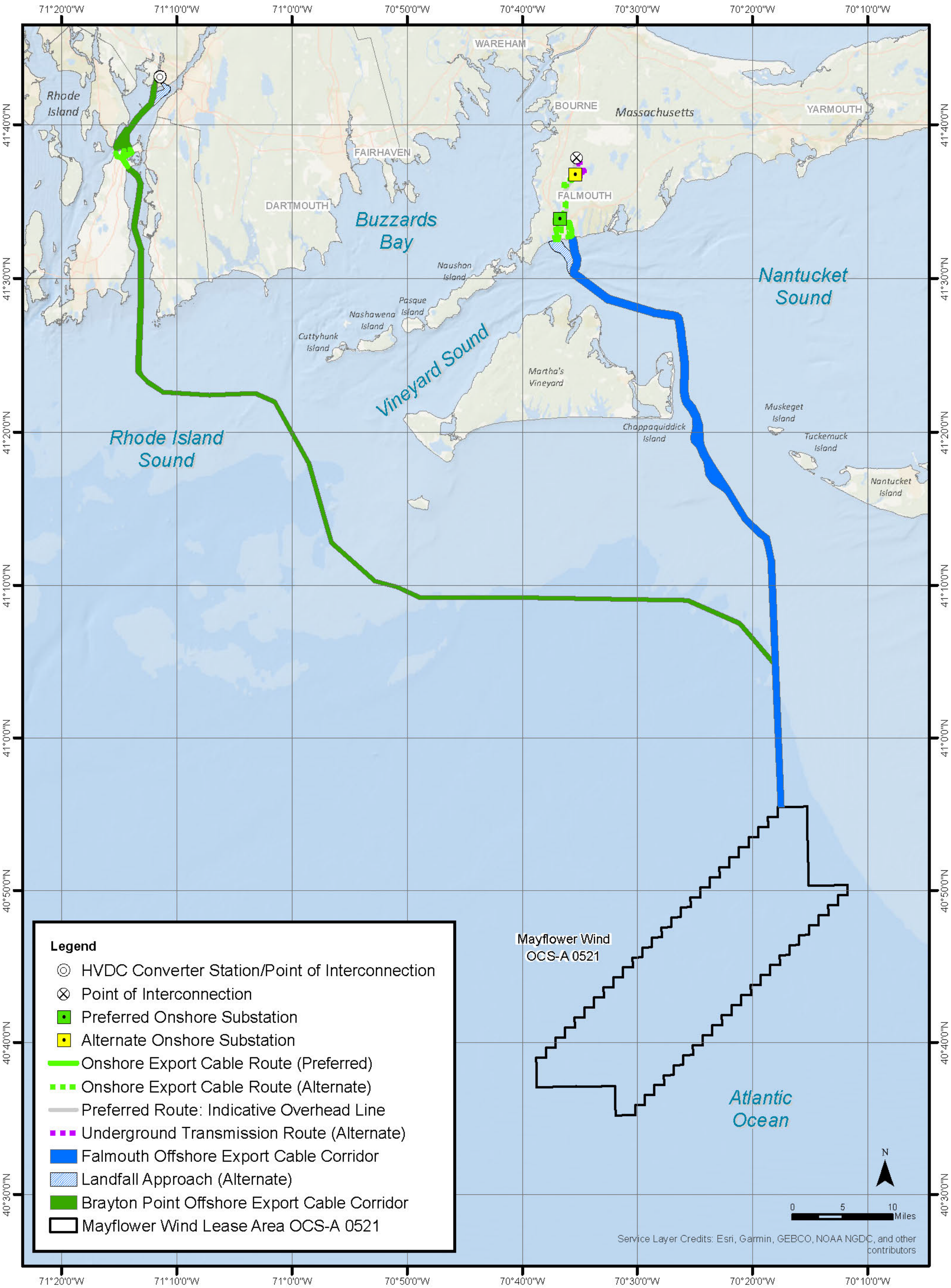
Species and Life Stages	Presence at Each Project Component								
	Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
Invertebrates									
Atlantic sea scallop (*Placopecten magellanicus*)									
Eggs	X	X			X				
Larvae	X	X			X				
Juvenile	X	X			X				
Adult	X	X			X				
Atlantic surfclam (*Spisula solidissima*)									
Juvenile	X	X	X	X					
Adult	X	X	X	X	X				
Longfin inshore squid (*Doryteuthis pealeii*)									
Eggs	X	X	X	X	X	X			
Juvenile (pre-recruits)	X	X	X	X	X	X	X	X	X
Adult (recruits)	X	X	X	X	X	X	X	X	X
Ocean quahog (*Arctica islandica*)									
Juvenile	X	X			X				
Adult	X	X			X				
Northern Shortfin Squid (*Illex illecebrosus*)									
Eggs									
Juvenile (pre-recruits)									
Adult (recruits)		X	X	X	X				
Skates									
Barndoor skate (*Dipturus laevis*)									
Juvenile	X								
Adult	X								

Species and Life Stages	Presence at Each Project Component: Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
Little skate (*Leucoraja erinacea*)									
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Winter skate (*Leucoraja ocellata*)									
Juvenile	X	X	X	X	X	X	X	X	X
Adult	X	X	X	X	X	X	X	X	X
Highly Migratory Species									
Albacore tuna (*Thunnus alalunga*)									
Spawning, Eggs, and Larvae	X(1)	X(1)							
Juvenile	X	X	X	X	X	X			
Adult	X	X	X	X	X				
Basking shark (*Cetorhinus maximus*)									
Neonate/YOY	X(1)	X(1)			X(1)				
Juvenile	X	X			X				
Adult	X	X			X				
Blue shark (*Prionace glauca*)									
Neonate/YOY	X	X			X				
Juvenile	X	X			X				
Adult	X	X			X				
Bluefin tuna (*Thunnus thynnus*)									
Spawning, Eggs, and Larvae									
Juvenile	X	X	X	X	X	X			
Adult	X	X	X	X	X				
Common thresher shark (*Alopias vulpinus*)									
Neonate/YOY	X	X	X	X	X				
Juvenile	X	X	X	X	X				
Adult	X	X	X	X	X				

Species and Life Stages	Presence at Each Project Component: Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
Dusky shark (*Carcharhinus obscurus*)									
Neonate/YOY	X	X			X				
Juvenile	X	X			X				
Adult	X	X			X				
Porbeagle shark (*Lamna nasus*)									
Neonate/YOY	X								
Juvenile	X								
Adult	X								
Sand tiger shark (*Carcharias taurus*)									
Larvae/Neonate/YOY	X	X	X	X	X	X	X	X	X
Juvenile	X	X	X	X	X	X	X	X	X
Adult									
Sandbar shark (*Carcharhinus plumbus*)									
Neonate/YOY									
Juvenile	X	X			X				
Adult	X	X			X				
Shortfin mako shark (*Isurus oxyrinchus*)									
Neonate/YOY	X	X			X				
Juvenile	X	X			X				
Adult	X	X			X				
Skipjack tuna (*Katsuwonus pelamis*)									
Spawning, Eggs, and Larvae									
Juvenile	X	X							
Adult	X	X	X	X	X	X			
Smoothhound shark complex (Atlantic Stock) (*Mustelus canis*)									
Neonate/YOY	X	X	X	X	X	X			
Juvenile	X	X	X	X	X	X			

Species and Life Stages	Presence at Each Project Component: Lease Area	Falmouth ECC	Worcester Avenue/ Central Park Landfalls	Shore Street Landfall	Brayton Point offshore ECC	Sakonnet River ECC	Mount Hope Bay ECC	Aquidneck Island Landfalls	Brayton Point Landfalls
Adult	X	X	X	X	X	X			
Tiger shark (*Galeocerdo cuvier*)									
Neonate/YOY									
Juvenile	X	X							
Adult	X	X							
White shark (*Carcharodon carcharias*)									
Neonate/YOY	X	X	X	X	X	X	X	X	
Juvenile	X	X	X	X	X				
Adult	X	X	X	X	X				
Yellowfin tuna (*Thunnus albacares*)									
Eggs and Larvae									
Juvenile	X	X	X	X	X	X	X	X	
Adult	X				X				

(1) Presumed EFH. Insufficient evidence known about the life stage.



Source: NOAA Habitat Conservation. 2020.

Figure 4-1. Offshore Project Area with 10-Minute Grid

4.3 Essential Fish Habitat Species and Life Stages

4.3.1 Finfish Species

4.3.1.1 American Plaice

American plaice is a species of right-eyed flounder that is found along the northeast coast of North America, from Labrador in Canada south to Rhode Island (NOAA, 2020). They are distributed along the continental shelves and, in the northwest Atlantic, are found throughout the Gulf of Maine and Georges Bank (NOAA, 2020). Adults are most commonly found 295 ft to 820 ft (90 m to 250 m) deep and on soft bottom surfaces. Larval plaice mostly eat plankton and adults primarily feed on bottom-dwelling invertebrates, such as brittle stars, sand dollars, polychaete worms, shrimps, and bivalve mollusks (NOAA, 2020), but also eat small fish such as the northern sand lance (*Ammodytes dubius*). American plaice can live for more than 20 years (NOAA, 2020).

Plaice, along with other groundfish in New England waters, are managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). According to the 2017 operational assessment, American plaice is not overfished and overfishing is not occurring (NOAA, 2020).

The larvae life stage of American plaice has known EFH within the Lease Area. Only life stages with EFH identified in the Offshore Project Area are discussed in this section.

Larvae: EFH is identified for pelagic habitats in the Gulf of Maine, on Georges Bank, and in southern New England, including in the high salinity zones of bays and estuaries listed in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017).

4.3.1.2 Atlantic Butterfish

The Atlantic butterfish is a semi-pelagic fish that forms loose schools that feed primarily on small invertebrates (NOAA, 2020). It averages 6 to 9 inches (in) (15 to 23 centimeters [cm]) in length, with some individuals reaching 12 in (30 cm) long and weighing up to 1.25 lb (570 grams [g]) (NOAA, 2020).

Butterfish range from Newfoundland to Florida but concentrate in the Gulf of Maine down to Cape Hatteras, North Carolina (Cross et al., 1999). Butterfish prefer sandy bottom environments rather than rocky environments. Spawning occurs on the continental shelf and nearshore areas and is common in Long Island Sound and the New York Bight during June and July. Adult butterfish feed mainly on planktonic prey, including squids and fish (Mid-Atlantic Fishery Council [MAFMC], 2011).

NOAA Fisheries and the MAFMC manage the butterfish fishery under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and Amendments. Butterfish are managed as one stock in the northern region (New England to Cape Hatteras) and two stocks south of Cape Hatteras. Butterfish are present in New England waters from spring to fall and are found from the surface to 180 ft (55 m) deep in the summer, but as deep as 690 ft (210 m) in the winter (Collette & Klein-MacPhee, 2002). Butterfish are a commercially and recreationally important fish, mostly targeted by pound nets, floating traps, purse seins, and otter trawls. The Atlantic butterfish is currently not overfished and overfishing is not occurring (NOAA, 2020).

EFH for the egg and larval stages of Atlantic butterfish is found throughout the entire Offshore Project Area, with the exception of the Worcester Avenue/Central Park and Shore Street Landfalls. Known EFH for Juvenile and Adult stages of the Atlantic Butterfish are found throughout the entire Offshore Project Area.

Eggs: EFH is identified for pelagic habitats in inshore estuaries and embayments that range from Massachusetts Bay to the southern shore of Long Island, New York. EFH is also identified in Chesapeake Bay and from Georges Bank to Cape Hatteras on the continental shelf and slope. EFH for Atlantic butterfish eggs is generally found over bottom depths up to 4,920 ft (1,500 m) or less where average temperatures in the upper 650 ft (200 m) of the water column are 44 to 71 degrees Fahrenheit (°F) (6.5 to 21.5 degrees Celsius [°C]) (MAFMC, 2011).

Larvae: EFH is identified for pelagic habitats in inshore estuaries and embayments in Boston Harbor, ranges from the south shore of Cape Cod, Massachusetts, to the Hudson River, in Delaware and Chesapeake bays, and on the continental shelf on western Georges Bank (the Great South Channel) to Cape Hatteras. EFH for Atlantic butterfish larvae is generally found over bottom depths between 135 and 1,150 ft (41 and 350 m) where average temperatures in the upper 656 ft (200 m) of the water column are 47 to 71°F (8.5 to 21.5°C) (MAFMC, 2011).

Juveniles: EFH is identified for pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound, North Carolina, inshore waters of the Gulf of Maine and the South Atlantic Bight, and on the inner and outer continental shelf from southern New England to South Carolina. EFH for juvenile Atlantic butterfish is generally found over bottom depths between 32 and 920 ft (10 and 280 m) where bottom water temperatures are between 44 to 81°F (6.5 and 27°C) and salinities are above 5 ppt. Juvenile butterfish feed mainly on planktonic prey (MAFMC, 2011).

Adults: EFH is identified for pelagic habitats in inshore estuaries and embayments from Massachusetts Bay to Pamlico Sound, North Carolina, inshore waters of the Gulf of Maine and the South Atlantic Bight, on Georges Bank, on the inner continental shelf south of Delaware Bay, and on the outer continental shelf from southern New England to South Carolina. EFH for adult Atlantic butterfish is generally in areas with bottom depths between 30 and 820 ft (10 and 250 m), bottom water temperatures are between 40 to 82°F (4.5 and 27.5°C) and salinities are above 5 ppt. Spawning likely does not occur at temperatures below 59°F (15°C) (MAFMC, 2011).

4.3.1.3 Atlantic Cod

Atlantic cod are heavy-bodied fish reaching sizes of up to 51 in (130 cm) and 77 lb (35 kg) (NOAA, 2020). Atlantic cod are top predators in the bottom ocean community, feeding on a variety of invertebrates and fish. Cod can live for more than 20 years and inhabit coastal and offshore waters. Their geographic range extends from Greenland to Cape Hatteras, North Carolina (NOAA, 2020).

Cod spawn from winter to early spring near the ocean floor and can begin reproducing at two to three years (NOAA, 2020). In U.S. waters cod is most common on Georges Bank and the western portion of the Gulf of Maine (NOAA, 2020). This fish species prefers muddy, gravelly, or rocky substrates. Cod spawn nearshore in the winter months (Collette & Klein-MacPhee, 2002).

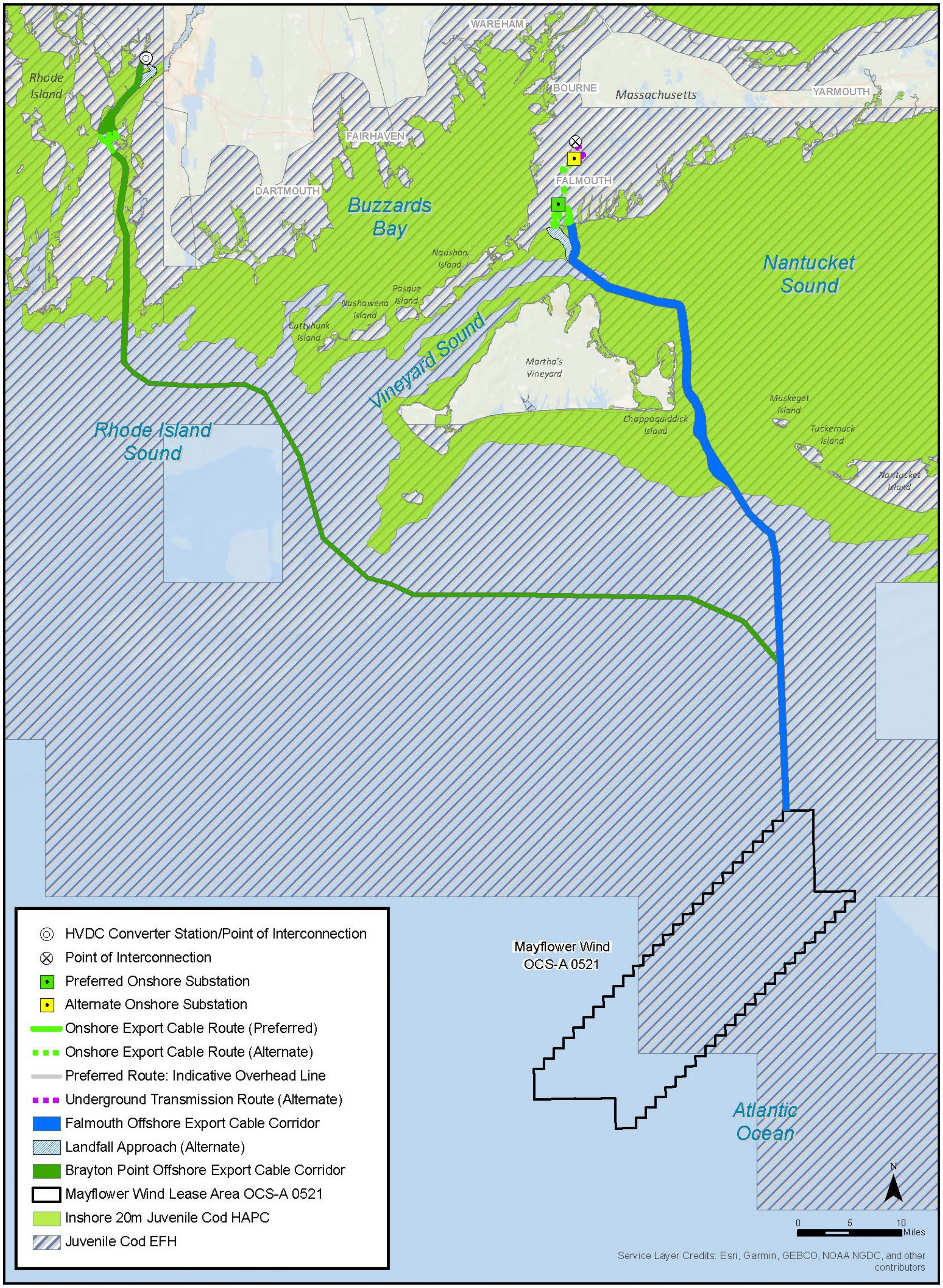
Atlantic cod have two separate stocks managed by NOAA, the Gulf of Maine and Georges Bank stock. The Gulf of Maine stock are found within the Offshore Project Area. Cod are historically an important commercial and recreational species and are still fished at low levels; however, both stocks are overfished, with fishing allowed, but at reduced levels. Cod is managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017).

An HAPC was designated for Inshore juvenile Atlantic cod for areas in the Gulf of Maine and southern New England below 65 ft (20 m). Rocky habitats are especially important to cod and perturbations of rocky habitats either direct (removal of habitat) or indirect (sedimentation) should be avoided. The Northern ECC and the Lease Area in Nantucket Sound could pose the greatest potential effects to Atlantic cod, as these locations contain the complex habitats, including Gravel Pavement, favored by juvenile cod (see Figure 4-2 and Attachment 1).

EFH for Atlantic cod eggs, larvae, and juveniles are found throughout the entire Project Area, and EFH for adults are found in the Lease Area, Falmouth ECC, Brayton Point offshore ECC, and Sakonnet River ECC.

Eggs: EFH is identified for pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region and in high salinity zones of the bays and estuaries listed in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Cod eggs are most often observed beginning in the fall, with peaks in the winter and spring.

Larvae: EFH is identified for pelagic habitats in the Gulf of Maine, on Georges Bank and in the Mid-Atlantic region and in high salinity zones of the bays and estuaries listed in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Cod larvae are most often observed in the spring.



Source: NOAA Fisheries. 2021.

Figure 4-2. Inshore Juvenile Cod Habitat Areas of Particular Concern

Juveniles: EFH is identified for intertidal and sub-tidal benthic habitats in the Gulf of Maine, southern New England, and on Georges Bank, to a maximum depth of 394 ft (120 m), including high salinity zones in bays and estuaries listed in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017).

Structurally complex habitats are essential habitats for juvenile cod. In inshore waters, YOY juveniles prefer gravel and cobble habitats and eelgrass beds after settlement, but in the absence of predators also utilize adjacent unvegetated sandy habitats for feeding and have been observed along the small boulders and cobble margins of rocky reefs in the Gulf of Maine. Survival rates for YOY cod are higher in more structured rocky habitats than in flat sand or eelgrass; growth rates are higher in eelgrass. Older juveniles move into deeper water and are associated with gravel, cobble, and boulder habitats, particularly those with attached organisms (NEFMC & NMFS, 2017).

Adults: EFH is identified for sub-tidal benthic habitats in the Gulf of Maine, south of Cape Cod, and on Georges Bank, including high salinity zones in bays and estuaries listed in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Cod depend on structurally complex hard bottom habitats composed of gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae are essential habitats for adult cod. However, cod do not exclusively inhabit hard bottomed habitats and can be found on sandy substrates and deeper slopes of ledges along shore. South of Cape Cod, spawning occurs in nearshore areas and on the continental shelf, usually in depths less than 230 ft (70 m) (NEFMC & NMFS, 2017).

4.3.1.4 Atlantic Herring

Atlantic herring are small schooling fish that can grow up to 14 in (35 cm) and live up to 15 years (NOAA, 2020). These pelagic fish are often found in schools in open waters (Collette & Klein-MacPhee, 2002). Geographically, they have a range from Labrador, Canada to Cape Hatteras with higher concentrations on the Georges Bank, Gulf of Maine, and Nantucket Shoals (Reid et al., 1999). Atlantic herring feed on zooplankton (tiny floating animals), krill, and fish larvae (NOAA, 2020). Herring eggs are deposited in mats on the seafloor. The Atlantic herring is typically present in the winter and average depths of about 120 to 360 ft (36 to 110 m) (Collette & Klein-MacPhee, 2002).

The Atlantic herring is managed through a single species FMP. The NEFMC, MAFMC, and ASMFC have developed a joint FMP that took effect March 19, 1979. The goal of the FMP was to manage herring stocks on Georges Bank and the Gulf of Maine to achieve higher levels of spawning and rebuild a juvenile herring resource and sardine fishery in the Gulf of Maine (NEFMC, 1999). Atlantic herring have and continue to be an important commercial fishery in New England. Herring form the base of the food chain as a forage fish for marine mammals, seabirds and many fish throughout the northeast. They are affordable bait for lobster, blue crab, and tuna fishermen and are also sold as canned sardines, steaks and kippers (ASMFC, 2020). A 2020 Management Track Assessment was completed by the Northeast Fisheries Science Center and peer-reviewed in June. The assessment is an update from the 2018 benchmark, and indicates the stock is overfished while overfishing is not occurring (ASMFC, 2020).

Known EFH for juvenile Atlantic Herring is found throughout the entire Offshore Project Area including all Landfall areas. Eggs have known EFH only within the Lease Area and Falmouth ECC. Additionally, EFH for adults and larvae are found throughout the entire Offshore Project Area with the exception of the Worcester Avenue/Central Park and Shore Street Landfalls.

Eggs: EFH is identified for inshore and offshore benthic habitats in the Gulf of Maine and on Georges Bank and Nantucket Shoals in depths of 16 to 295 ft (5 to 90 m) on coarse sand, pebbles, cobbles, and boulders and/or macroalgae at the locations shown in the Final Omnibus EFH Amendment 2 (NEFMC & NMFS, 2017). Eggs adhere to the bottom, often in areas with strong bottom currents, forming egg “beds” that may be many layers deep.

Larvae: EFH is identified for inshore and offshore pelagic habitats in the Gulf of Maine, on Georges Bank, and in the upper Mid-Atlantic Bight and in bays and estuaries listed in the Final Omnibus EFH Amendment 2 (NEFMC & NMFS, 2017). Atlantic herring larvae are transported long distances to inshore and estuarine waters where they metamorphose into early stage juveniles. Atlantic herring larvae are observed between August and April, with peaks from September through November (NEFMC & NMFS, 2017).

Juveniles: EFH is identified for intertidal and sub-tidal pelagic habitats to 984 ft (300 m) throughout the region, including the bays and estuaries listed in the Final Omnibus EFH Amendment 2 (NEFMC & NMFS, 2017). One and two-year old juveniles create large schools and very infrequently conduct seasonal inshore-offshore migrations. YOY juveniles can tolerate low salinities, but older juveniles avoid brackish water (NEFMC & NMFS, 2017).

Adults: EFH is identified throughout the region's bays and estuaries for sub-tidal pelagic habitats (NEFMC & NMFS, 2017). Adults make extensive seasonal migrations between summer and fall spawning grounds on Georges Bank and the Gulf of Maine and overwintering areas in southern New England and the Mid-Atlantic region. Except during periods of spawning, the species seldom migrate beyond a depth of about 330 ft (100 m) and generally avoid water temperatures above 50°F (10°C) and low salinities. Spawning takes place on the bottom, on a variety of substrates, generally in depths of 16 to 295 ft (5 to 90 m) (NEFMC & NMFS, 2017).

4.3.1.5 Atlantic Mackerel

The Atlantic mackerel is a pelagic, schooling species of fish that ranges from the Gulf of St. Lawrence to Cape Lookout, North Carolina (Studholme et al., 1999). Mackerel are managed as one stock under the MAFMC through the Squid-Mackerel-Butterfish FMP (MAFMC, 2011). This finfish species is migratory throughout the waters of New England and appears during spring and summer in near-surface waters (Collette & Klein-MacPhee, 2002). The current trend of mackerel stock biomass is increasing (Studholme et al., 1999). Mackerel school in open waters towards the surface in nearshore environments. Mackerel spawn off the coast in deeper waters across from a range between Cape Hatteras to the Gulf of St. Lawrence covering almost the entire continental shelf. Spawning occurs in early summer and continues until the water temperature reaches 46°F (8°C). There is no preferred breeding habitat (Collette & Klein-MacPhee, 2002). Adult Atlantic mackerel are opportunistic predators feeding primarily on a wider range and larger individuals of pelagic crustaceans than juveniles, but also on fish and squid.

Known EFH for Atlantic mackerel for juveniles is found in the entire Project Area. EFH for eggs and larvae is found in all of the ECCs, Lease Area, and the Aquidneck and Brayton Point Landfalls. Additionally, EFH for the adult life stage is found in the Lease Area, Sakonnet River ECC, Mount Hope Bay ECC, Aquidneck Landfalls and Brayton Point Landfalls.

Eggs: EFH is identified for pelagic habitats in inshore estuaries and embayments from New Hampshire to the south shore of Long Island, New York, inshore and offshore waters of the Gulf of Maine, and on the continental shelf from Georges Bank to Cape Hatteras, mostly north of 38 °N. EFH for Atlantic mackerel eggs is generally found over bottom depths of 328 ft (100 m) or less with average water temperatures of 43 to 54°F (6.5 to 12.5°C) in the upper 59 ft (15 m) of the water column.

Larvae: EFH is identified for pelagic habitats in the same geographic regions as eggs. EFH for Atlantic mackerel larvae is generally found over bottom depths between 68 and 328 ft (21 and 100 m) with average water temperatures of 42 to 52°F (5.5 to 11.5°C) in the upper 656 ft (200 m) of the water column.

Juveniles: EFH is identified for pelagic habitats in inshore estuaries and embayments from Passamaquoddy Bay and Penobscot Bay, Maine to the Hudson River, in the Gulf of Maine, and on the continental shelf from Georges Bank to Cape Hatteras. EFH for juvenile Atlantic mackerel is generally found over bottom depths between 32 and 360 ft (10 and 110 m) and in water temperatures of 41 to 68°F (5 to 20°C). Juvenile Atlantic mackerel feed primarily on small crustaceans, larval fish, and other pelagic organisms.

Adults: EFH is identified for pelagic habitats in the same geographic extent as juveniles. EFH for adult Atlantic mackerel is generally found over bottom depths less than 560 ft (170 m) and in water temperatures of 41 to 68°F (5 to 20°C). Spawning occurs at temperatures above 45°F (7°C), with a peak between 48 and 57°F (9 and 14°C).

4.3.1.6 Atlantic Wolffish

Atlantic wolffish range from Labrador in Canada south to the Great South Channel and Georges Bank (NOAA, 2020). Atlantic wolffish have a tapered body shape with a large rounded head with multiple rows of teeth and a slender tail (NOAA, 2020). Adult wolffish primarily feed on bottom-dwelling invertebrates, such as scallops, hermit crabs, Jonah crabs, and sea urchins (NOAA, 2020). Wolffish inhabit complex hard or rocky bottom terrain and are generally solitary and sedentary.

Atlantic wolffish are managed by NOAA in a single stock and is a zero-possession species, meaning vessels holding a federal groundfish permit may not fish for, possess, or land Atlantic wolffish. They are managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017).

The Atlantic wolffish has known EFH for all life stages in the Falmouth ECC and Falmouth Landfalls, and Brayton Point offshore ECC, but none in the Lease Area.

Eggs: Sub-tidal benthic habitats at depths less than 330 ft (100 m) within the geographic area in shown in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Wolffish egg masses are hidden under rocks and boulders in nests.

Larvae: Pelagic and sub-tidal benthic habitats within the geographic area shown in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Atlantic wolffish larvae remain near the bottom for up to six days after hatching, but gradually become more buoyant as the yolk sac is absorbed.

Juveniles (<25 in [< 65 cm] total length [TL]): Sub-tidal benthic habitats at depths of 230 to 600 ft (70 to 184 m) within the geographic area are shown in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Juvenile Atlantic wolffish do not have strong substrate preferences.

Adults (>25 in [>65 cm] TL): Sub-tidal benthic habitats at depths less than 570 ft (173 m) within the geographic area are shown in the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Adult Atlantic wolffish have been observed spawning and guarding eggs in rocky habitats in less than 100 ft (30 m) of water in the Gulf of St. Lawrence and Newfoundland and in deeper (165 to 330 ft [50 to 100 m]) boulder reef habitats in the Gulf of Maine. Egg masses have been collected on the Scotian Shelf in depths of 330 to 1100 ft (100 to 130 m), indicating that spawning is not restricted to coastal waters. Adults are distributed over a wider variety of sand and gravel substrates once they leave rocky spawning habitats but are not caught over muddy bottom.

4.3.1.7 Black Sea Bass

The black sea bass is a demersal finfish species that concentrates on the U.S. East Coast from Cape Cod to Florida (NOAA, 2020). They migrate offshore and south in the fall, returning north and inshore to coastal areas and bays in spring. Black sea bass grow slowly, reaching up to 2 ft (60 cm) and 9 lb (4 kg) (NOAA, 2020). Black sea bass eat whatever prey is available, but primarily target crabs, shrimp, worms, small fish, and clams (NOAA, 2020). Black sea bass are protogynous hermaphrodites, which mean they start life as a female and then change sex to become males when they reach 9 to 13 in (23 to 33 cm) (2 to 5 years of age) (ASMFC, 2020). Black sea bass prefer structured habitats such as reefs, shipwrecks, and lobster pots along the continental shelf (Steimle et al., 1999a). Black sea bass spawn in May along the North Carolina coast, then spawn from the middle of May until the end of June in New Jersey, New York, and southern New England waters (Collette & Klein-MacPhee, 2002).

Black sea bass are managed jointly by NOAA Fisheries, the ASMFC and the MAFMC under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan and Amendments. Black sea bass exist as three separate stocks: the northern, southern, and Gulf of Mexico stocks. The northern stock, which occurs north of Cape Hatteras, is the subject of this EFH description. This stock occurs irregularly in the cool waters north of Cape Cod and into the Gulf of Maine. They are rarely caught in New Hampshire waters and are nearly absent in Maine waters (Steimle et al., 1999a). Their distribution changes seasonally as fish migrate from coastal areas south and offshore to the outer continental shelf in the fall and winter but return to coastal structured habitats for the spring and summer. According to the 2019 stock assessment, the black sea bass stock in the Mid-Atlantic is not overfished and is not subject to overfishing (NOAA, 2020).

Known EFH for black sea bass is found throughout the entire Offshore Project Area for both juvenile and adult life stages.

Juveniles (< 7.5 in [19 cm] TL): Juveniles can be found in bays and estuaries to offshore waters over the continental shelf (from the coast out to the limits of the exclusive economic zone [EEZ]). Juveniles are found in the estuaries in the summer and in waters warmer than 43°F (6°C) with salinities greater than 18 ppt and coastal areas between Virginia and Massachusetts, but winter offshore from New Jersey and south. Juvenile black sea bass prefer habitats with a degree of rugosity (e.g., rough bottom, shellfish and eelgrass beds, and man-made structures in sand-shell areas; offshore clam beds and shell patches may also be used for over-wintering) (ASMFC, 1998).

Adults (≥ 7.5 in [19 cm] TL): Adult black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina, generally in waters above 43°F (6°C). Like juveniles, adults prefer structured habitats.

4.3.1.8 Bluefish

Bluefish range on the U.S. East Coast from Maine to Florida (NOAA, 2020). They are a highly migratory, schooling species that migrates seasonally to the mid-Atlantic bight during the spring (Fahay et al., 1999). They grow quickly, reaching up to 31 lb (14 kg) and 39 in (1 m). They exhibit a feeding behavior where large schools of big fish attack bait fish near the surface, churning the water and eating almost anything they can catch and swallow (NOAA, 2020). Bluefish prefer open water environments and can be found both nearshore and offshore. Bluefish spawn multiple times in spring through summer.

NOAA Fisheries, MAFMC, and ASMFC manage the bluefish fishery under the Bluefish Management Plan and Addenda (MAFMC, 1998a). According to the 2019 stock assessment, bluefish are not overfished and not subject to overfishing (NOAA, 2020). Bluefish are targeted by recreational anglers and the majority of the catch is allotted to recreational fisheries (NOAA, 2020).

Known EFH for adult bluefish is found throughout the entirety of the Offshore Project Area, except for the Falmouth Landfalls. EFH for juvenile bluefish incudes Brayton Point offshore ECC, Sakonnet River ECC, Mount Hope Bay ECC, Aquidneck Island Landfalls and Brayton Point Landfalls.

Adults: Adult bluefish are found in North Atlantic estuaries from June through October in the "mixing" and "seawater" zones. The distribution of the species varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (greater than 25 ppt) (MAFMC, 1998a).

4.3.1.9 Haddock

Haddock, also known as scrod, are a member of the cod family, but they are smaller than Atlantic cod, ranging between 1 to 3 ft (30 to 90 cm) long at maturity (NOAA, 2020). In the western North Atlantic, haddock are found from Newfoundland to Cape May, New Jersey, and are most abundant on Georges Bank, and in the Gulf of Maine (NOAA, 2020). They feed on a variety of bottom-dwelling animals, including mollusks, worms, crustaceans, sea stars, sea urchins, sand dollars, brittle stars, and occasionally fish eggs, with the adults sometimes eating small fish, especially herring (NOAA, 2020).

Haddock are found at depths ranging from 50 to 1,150 ft (15 to 350 m) and there is a very minimal seasonal difference between depths aside from a slightly wider range of depths in the fall (Cargnelli et al., 1999a). These finfish prefer gravely, pebbly, clay, and sandy substrates and avoid ledges and large rocks (Collette & Klein-MacPhee, 2002).

There are two stocks of haddock in U.S. waters, the Gulf of Maine and Georges Bank stocks. They are managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). According to the 2019 stock assessments, neither of the haddock stocks are overfished and neither are subject to overfishing (NOAA, 2020).

Haddock have known EFH for all life stages in the Lease Area and EFH for eggs and larvae in the Falmouth ECC and Brayton Point offshore ECC.

Eggs: EFH is identified for pelagic habitats in coastal and offshore waters in the Gulf of Maine, southern New England, and on Georges Bank (NEFMC & NMFS, 2017).

Larvae: EFH is identified for pelagic habitats in coastal and offshore waters in the Gulf of Maine, the Mid-Atlantic, and on Georges Bank (NEFMC & NMFS, 2017).

Juveniles: EFH is identified for sub-tidal benthic habitats between 131 and 459 ft (40 and 140 m) in the Gulf of Maine, on Georges Bank and in the Mid-Atlantic region, and as shallow as 66 ft (20 m) along the coast of Massachusetts, New Hampshire, and Maine (NEFMC & NMFS, 2017). YOY juveniles settle on sand and gravel on Georges Bank, but are found predominantly on gravel pavement areas within a few months after settlement. As they grow, they disperse over a greater variety of substrate types on the bank. YOY haddock do not inhabit shallow, inshore habitats.

Adults: EFH is identified for sub-tidal benthic habitats between 164 and 525 ft (50 and 160 m) in the Gulf of Maine, on Georges Bank, and in southern New England (NEFMC & NMFS, 2017). Adult Haddock prefer bottom habitats with substrates consisting of broken ground, pebbles, smooth hard sand, and “smooth areas” between rocky patches on Georges Bank and around Nantucket Shoals.

4.3.1.10 Monkfish

Monkfish are tadpole-like in appearance, with a body that is mostly a broad head with a large mouth and a narrow, tapering body. Females typically live to at least 13 years and grow to more than 4.5 ft (137 cm) long, while males only live about seven years and grow to almost 3 ft (90 cm) long (NOAA, 2020). Adults mainly eat fish, including other monkfish, but also feed on crustaceans, mollusks, seabirds, and diving ducks. Monkfish are found in the Northwest Atlantic Ocean from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina. They can tolerate a wide range of temperatures and depths, from inshore waters down to nearly 3,000 ft (915 m) (NOAA, 2020).

Monkfish are managed in two stocks, a northern stock and a southern stock, by NOAA Fisheries and the New England and Mid-Atlantic Fishery Councils. The commercial monkfish fishery in the U.S. operates from Maine to North Carolina out to the continental margin. Trawl gear is primarily used in northern waters, and gillnet gear in southern waters (NOAA, 2020). According to the 2013 stock assessment, monkfish are not overfished and are not subject to overfishing in both the northern and southern areas (NOAA, 2020). They are managed under the under the Monkfish Fishery Management Plan (NEFMC, 2017).

Monkfish have known EFH for egg and larval life stages in the Lease Area, Falmouth ECC and Brayton Point offshore ECC. EFH for juvenile and adult life stages are located in the Lease Area and the Brayton Point offshore ECC.

Eggs: EFH is identified for pelagic habitats in inshore areas, and on the continental shelf and slope throughout the Northeast region (NEFMC & NMFS, 2017). Monkfish eggs are buoyant and are shed in large masses referred to as mucoidal egg “veils.” The veils are often observed during the months from March to September.

Larvae: EFH is pelagic in inshore areas, and on the continental shelf and slope throughout the Northeast region (NEFMC & NMFS, 2017). Monkfish larvae are more abundant in the Mid-Atlantic region and occur over a wide depth range, from the surf zone to depths up to 4,920 ft (1,500 m).

Juveniles: EFH is identified for sub-tidal benthic habitats in depths of 165 to 1,310 ft (50 to 400 m) in the Mid- Atlantic, between 65 and 1,310 ft (20 and 400 m) in the Gulf of Maine, and to a maximum depth of 3,300 ft (1,000 m) on the continental slope (NEFMC & NMFS, 2017). A variety of EFH occurs for juvenile monkfish, ranging from hard sand, pebbles, and gravel, to broken shells and soft mud; they also seek shelter among rocks with attached algae. YOY juveniles have been collected primarily on the central portion of the shelf in the Mid- Atlantic, but also in shallow nearshore waters off eastern Long Island, up the Hudson Canyon shelf valley, and around the perimeter of Georges Bank. They have also been collected at depths up to 2,950 ft (900 m) on the continental slope.

Adults: In the Gulf of Maine and the continental shelf, EFH is identified for sub-tidal benthic habitats between 66 and 1,312 ft (20 and 400 m) in the Gulf of Maine, and to a maximum depth of 3,280 ft (1,000 m) on the continental slope (NEFMC & NMFS, 2017). EFH for adult monkfish is similar to that of juveniles, and ranges from hard sand, pebbles, gravel, and broken shells to soft mud. Similar to juveniles, adult monkfish prefer soft sediments (fine sand and mud) over sand and gravel and may utilize the edges of rocky areas in the mud habitats for feeding.

4.3.1.11 Ocean Pout

Ocean pout are found along the Atlantic Coast of North America from Labrador to Delaware (NOAA, 2020). Ocean pout have a long, tapered, eel-like body and a wide fleshy mouth, and grow up to 46 in (117 cm) long. Ocean pout are present in a variety of habitats including sandy mud, sticky sand, on pebbles and gravel (Collette & Klein-MacPhee, 2002). Adult ocean pout typically feed on a variety of bottom-dwelling invertebrates, such as bivalve mollusks, sea urchins, sand dollars, brittle stars, and crabs Delaware (NOAA, 2020).

NOAA Fisheries and the NEFMC manage a single stock of ocean pout in U.S. waters under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Ocean pout is a zero-possession species, meaning vessels holding a federal groundfish permit may not fish for, possess, or land ocean pout. According to the 2017 stock assessment, ocean pout is overfished and is not currently experiencing overfishing (NOAA, 2020).

Ocean Pout have known EFH for egg life stage located in the Lease Area, Falmouth ECC, Brayton Point offshore ECC, Sakonnet River ECC, Aquidneck Landfalls, and Mount Hope Bay ECC. Juvenile and adult Ocean Pout have EFH found within the Lease Area and both the Falmouth ECC and Brayton Point offshore ECC. There is no true larval stage for this species, so the Council proposes to eliminate the no action larval EFH designation (NEFMC & NMFS, 2017).

Eggs: EFH is identified for hard bottom habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic Bight, as well as the high salinity zones of the bays and estuaries (NEFMC & NMFS, 2017). Eggs are laid in gelatinous masses, generally in sheltered nests, holes, or rocky crevices in fall. The development of eggs takes two to three months, from fall into winter. EFH for ocean pout eggs occurs in depths less than 330 ft (100 m) on rocky bottom habitats.

Juveniles: EFH is identified for intertidal and sub-tidal benthic habitats in the Gulf of Maine and on the continental shelf north of Cape May, New Jersey, on the southern portion of Georges Bank, and in the high salinity zones of a number of bays and estuaries north of Cape Cod, extending to a maximum depth of 390 ft (120 m) (NEFMC & NMFS, 2017). Essential fish habitat for juvenile ocean pout occurs on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel.

Adults: EFH is identified for sub-tidal benthic habitats between 66 and 459 ft (20 and 140 m) in the Gulf of Maine, on Georges Bank, in coastal and continental shelf waters north of Cape May, New Jersey, and in the high salinity zones of a number of bays and estuaries north of Cape Cod (NEFMC & NMFS, 2017). EFH for adult ocean pout includes mud and sand, particularly in association with structure forming habitat types; i.e. shells, gravel, or boulders. In softer sediments, they burrow tail first and leave a depression on the sediment surface. Ocean pout congregate in rocky areas prior to spawning and frequently occupy nesting holes under rocks or in crevices in depths less than 328 ft (100 m) (NEFMC & NMFS, 2017).

4.3.1.12 Offshore Hake

Offshore hake are known to inhabit the outer continental shelf and upper slope, with adults coming to the surface at night to feed. Hake are a member of the cod family and feed primarily on crustaceans such as decapods and rock crabs as well as fish.

Along with red hake and silver hake, they are part of the small-mesh multispecies fishery, which is managed primarily through a series of exemptions from the Northeast Multispecies Fishery Management Plan (or groundfish fishery) (NEFMC & NMFS, 2017).

Offshore Hake have known EFH for the larvae life stage in the Lease Area and Falmouth ECC.

Larvae: EFH is identified for pelagic habitats along the outer continental shelf and slope between 200 and 4,290 ft (60 and 1,500 m) (NEFMC & NMFS, 2017).

4.3.1.13 Atlantic Pollock

Atlantic pollock are found in the Northwest Atlantic Ocean and are most common on the western Scotian Shelf and in the Gulf of Maine. They typically grow to more than 3.5 ft (1 m) and can live up to 23 years (NOAA, 2020). Smaller pollock in inshore waters feed on small crustaceans and small fish, while larger Atlantic pollock mainly prey on fish (NOAA, 2020). Atlantic pollock spawn multiple times per season from November through February over hard, stony, or rocky ocean bottoms in areas throughout the Gulf of Maine and Georges Bank.

They are managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). According to the 2019 stock assessment, Atlantic pollock is not overfished and is not subject to overfishing (NOAA, 2020).

Known EFH for the egg life stage of pollock is found in the Lease Area and the Brayton Point offshore ECC. Known EFH for the larval life stage is found in the Lease Area, Falmouth ECC and Brayton Point offshore ECC. Juvenile pollock can be found within the Lease Area, Brayton Point offshore ECC, the Sakonnet River ECC, Aquidneck Island Landfalls, Mount Hope Bay ECC, and Brayton Point Landfalls.

Eggs: EFH is identified for pelagic inshore and offshore habitats in the Gulf of Maine, on Georges Bank, and in southern New England (NEFMC & NMFS, 2017).

Juveniles: EFH is identified for inshore and offshore pelagic habitats from the intertidal zone to 591 ft (180 m) in the Gulf of Maine, in Long Island Sound, and Narragansett Bay, between 131 ft and 591 ft (40 and 180 m) on western Georges Bank and the Great South Channel, and in mixed and full salinity waters in a number of bays and estuaries north of Cape Cod (NEFMC & NMFS, 2017). EFH for juvenile life stage consists of rocky bottom habitats with attached macroalgae that provide refuge, as well as shallow water eelgrass beds in the Gulf of Maine (NEFMC & NMFS, 2017). Older juveniles migrate to deeper water in habitats occupied by adults (NEFMC & NMFS, 2017).**Larvae:** EFH is identified for pelagic inshore and offshore habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region (NEFMC & NMFS, 2017).

4.3.1.14 Red Hake

Red hake are a member of the cod family and range primarily from Newfoundland to North Carolina, with the greatest abundance from the western Gulf of Maine through Southern New England waters.

They normally reach a maximum size of 20 in (50 cm) and 4.4 lb (2 kg) (NOAA, 2020). Red hake feed primarily on crustaceans such as decapods and rock crabs as well as fish such as haddock, silver hake, sea robins, sand lance, mackerel, and small red hake NOAA, 2020). Spawning occurs uniformly from Georges Bank to Nova Scotia and typically occurs nearshore as early as June and continues through fall (Collette & Klein-MacPhee, 2002). Red hake eggs are most often observed during the months from May to November, with peaks in June and July and larvae are most often observed from May through December, with peaks in September to October.

The red hake fishery in the U.S. operates from Maine to Cape Hatteras, North Carolina (NOAA, 2020). Along with silver hake and offshore hake, it is a part of the small-mesh multispecies fishery, which is managed primarily through a series of exemptions from the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). The directed commercial fishery is conducted with small-mesh trawl gear with a number of specific requirements to reduce bycatch of larger groundfish species. There are two stocks of red hake: the Gulf of Maine/Northern Georges Bank and Southern Georges Bank/Mid Atlantic stock. According to the 2017 stock assessments the Gulf of Maine/Northern Georges Bank (northern) stock of red hake is not overfished and is not subject to overfishing, while the Southern Georges Bank/Mid Atlantic (southern) stock of red hake is overfished and subject to overfishing (NOAA, 2020).

Red hake has known EFH for all life stages in all areas of the Offshore Project Area, except for the Worcester Avenue/Central Park and Shore Street Landfalls.

Eggs and Larvae: EFH is identified for pelagic habitats in the Gulf of Maine, on Georges Bank, and in the Mid- Atlantic (NEFMC & NMFS, 2017).

Juveniles: Throughout the region EFH is identified for intertidal and sub-tidal benthic habitats (including bays and estuaries) on mud and sand substrates, to a depth of 260 ft (80 m) (NEFMC & NMFS, 2017). Bottom habitats with sufficient rugosity (reefs, anemone-tube worm complexes, etc.) provide EFH for juvenile red hake. Newly settled juveniles occur in depressions on the open seabed; while, older juveniles generally utilize shelter or structure and often inside live bivalves.

Adults: Adults can be found In the Gulf of Maine and the outer continental shelf and slope in depths from 65 ft (20 m) to 2,460 ft (750 m) (NEFMC & NMFS, 2017). Adults prefer shell beds, soft sediments and artificial reefs, the species is less commonly found on gravel bottoms.

4.3.1.15 Scup

Scup, also known as porgy, are demersal finfish are found in the Northwest Atlantic Ocean, primarily between Cape Cod and Cape Hatteras (NOAA, 2020). Scup grow slowly, up to about 20 in (50 cm) long and 4 lb (1.8 kg), living about 20 years. Scup are browsers that eat invertebrates that live on the ocean bottom. Scup prefer smooth to rocky bottom habitats and usually form schools around such bottoms. They prefer temperatures greater than 45°F (7°C) and are most frequently encountered in water temperatures from 55 to 77°F (13 to 25°C) (ASMFC, 2020. Spawning occurs nearshore and in relatively shallow waters over sandy bottom between May and August (Steimle et al., 1999b).

Scup is jointly managed by NOAA Fisheries, ASMFC and MAFMC under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan and its subsequent Amendments. According to the 2019 stock assessment for scup in the Mid-Atlantic and New England, scup are not overfished and are not subject to overfishing. The recreational fishery for scup is significant, with anglers accounting for 17 to 67 percent of total annual catches from 1981-2018 (ASMFC, 2020).

Known EFH for juvenile and adult life stages of scup are found throughout all portions of the Offshore Project Area. Egg and larval life stages of scup can be found along the Sakonnet River ECC, Aquidneck Island Landfalls, Mount Hope Bay ECC, and Brayton Point Landfalls.

Eggs and Larvae: Little is known about the egg and larval stages of scup. Larval scup can be found in coastal-estuarine waters during warmer months (MAFMC, 1998b).

Juveniles: Juvenile scup can be found in estuaries to waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, Juveniles are found during the summer and spring in estuaries and bays between Virginia and Massachusetts in water temperatures greater than 45°F (7°C) and salinities greater than 15 ppt, in association with a variety of habitats (MAFMC, 1998b).

Adults: Adult Scup generally inhabit the same waters as juvenile scup. Wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45°F (7°C) (MAFMC, 1998b).

4.3.1.16 Silver Hake

Silver hake are found in the Northwest Atlantic Ocean and range primarily from Newfoundland to South Carolina (NOAA, 2020). Silver hake are voracious predators, feeding on fish, crustaceans, and squid. They can grow up to 28 in (71 cm) long and up to 5 lb (2.3 kg) (NOAA, 2020). These demersal finfish are generally present from 420 to 600 ft (130 to 180 m) deep water depths (Collette & Klein-MacPhee, 2002).

There are two stocks of silver hake, the Gulf of Maine and Northern Georges Bank (northern stock) and Southern Georges Bank and Mid-Atlantic (southern stock) (NOAA, 2020). Both stocks are not overfished and are not subject to overfishing. There is little to no separation of silver hake and offshore hake in the market, and both are generally sold under the name “whiting.” The whiting fishery in the U.S. operates from Maine to Cape Hatteras, North Carolina. Along with red hake, whiting are part of the small-mesh multispecies fishery, which is managed primarily through a series of exemptions from the NEFMP (or groundfish fishery). The directed commercial fishery is conducted with small-mesh trawl gear with a number of specific requirements to reduce bycatch of larger groundfish species.

Silver hake have known EFH for egg and larval life stages in the Lease Area, Falmouth ECC, Brayton Point offshore ECC, Sakonnet River ECC, Aquidneck Island Landfalls, Mount Hope Bay ECC, and Brayton Point Landfalls. EFH for juvenile silver hake is found within the Lease Area and the Falmouth ECC. The adult life stage is found within the Lease Area, Falmouth ECC, Brayton Point offshore ECC, Sakonnet River ECC, Aquidneck Island Landfalls, and Mount Hope Bay ECC.

Eggs and Larvae: EFH is from the Gulf of Maine to Cape May, New Jersey, including Cape Cod and Massachusetts Bays (NEFMC & NMFS, 2017). Silver hake eggs are observed all year, with peaks from June through October; silver hake larvae are observed all year, with peaks from July through September.

Juveniles: EFH is identified for pelagic and benthic habitats in the Gulf of Maine, including the coastal bays and estuaries, and on the continental shelf as the Delaware River. In the Offshore Project Area, silver hake could occur in waters deeper than 33 ft (10 m) (NEFMC & NMFS, 2017). Juvenile silver hake are found in association with sand-waves, flat sand with amphipod tubes, and shells, and in biogenic depressions. Juveniles in the New York Bight settle to the bottom at mid-shelf depths on muddy sand substrates and find refuge in amphipod tube mats.

Adults: Pelagic and benthic habitats at depths greater than 115 ft (35 m) in the Gulf of Maine and the coastal bays and estuaries, and in some shallower locations nearer the coast, on sandy substrates (NEFMC & NMFS, 2017). Adult silver hake are often found in bottom depressions or in association with sand waves and shell fragments. They have also been observed at high densities in mud habitats bordering deep boulder reefs, resting on boulder surfaces, and foraging over deep boulder reefs in the southwestern Gulf of Maine. This species makes greater use of the water column (for feeding, at night) than red or white hake.

4.3.1.17 Spiny Dogfish

The spiny dogfish is a small coastal shark found in the North Atlantic and North Pacific Oceans, mostly in the temperate and subarctic areas. In the Northwest Atlantic, they are found from Labrador to Florida and are most abundant between Nova Scotia and Cape Hatteras (NOAA, 2020). Spiny dogfish migrate north in the spring and summer and south in the fall and winter (ASMFC, 2020) and are common in New England, found on Georges Bank from March to April (Collette & Klein-MacPhee, 2002). Males grow up to 3.3 ft (1 m), while females grow slightly larger up to 4 ft (1.2 m). They are opportunistic feeders, preying on whatever is available, with smaller individuals tending to feed primarily on crustaceans, while larger ones eat jellyfish, squid, and schooling fish (NOAA, 2020). Dogfish spawn in deeper waters along the continental shelf.

The spiny dogfish is jointly managed by NOAA Fisheries, ASMFC, NEFMC, and MAFMC under the Spiny Dogfish Fishery Management Plan and its subsequent Amendments. According to the 2018 stock assessment, Atlantic spiny dogfish are not overfished and are not subject to overfishing (NOAA, 2020).

Spiny Dogfish have known EFH for all sub-adult and adult life stages in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC. Juvenile spiny dogfish have EFH in the Lease Area. No descriptions are available for eggs and larvae (MAFMC, 2014).

Female Sub-Adults (14-31 in [36-79 cm]): Pelagic and epibenthic habitats throughout the region. Sub-adult females are found over a wide depth range in full salinity seawater (32 to35 ppt) where bottom temperatures range from 45 to 59°F (7 to 15°C). Sub-adult females are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59°F (15°C) (MAFMC, 2014).

Male Sub-Adults (14 to 23 in [36-59 cm]): Pelagic and epibenthic habitats, primarily in the Gulf of Maine and on the outer continental shelf from Georges Bank to Cape Hatteras. Sub-adult males are found over a wide depth range in full salinity seawater (32 to 35 ppt) where bottom temperatures range from 45 to 59°F (7 to 15°C). Sub-adult males are not as widely distributed over the continental shelf as the females and are generally found in deeper water. They are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59°F (15°C) (MAFMC, 2014).

Female Adults (≥ 31 in [80 cm]): Pelagic and epibenthic habitats throughout the region. Adult females are found over a wide depth range in full salinity seawater (32 to 35 ppt) where bottom temperatures range from

45 to 59°F (7 to 15°C). They are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59°F (15°C) (MAFMC, 2014).

Male Adults (≥ 23 in [60 cm]): Pelagic and epibenthic habitats throughout the region. Adult males are found over a wide depth range in full salinity seawater (32 to 35 ppt) where bottom temperatures range from 45 to 59°F (7 to 15°C). They are widely distributed throughout the region in the winter and spring when water temperatures are lower, but very few remain in the Mid-Atlantic area in the summer and fall after water temperatures rise above 59°F (15°C) (MAFMC, 2014).

4.3.1.18 Summer Flounder

Summer flounder is a demersal species found in the Atlantic Ocean from Nova Scotia to the east coast of Florida; in U.S. waters they are most common in the mid-Atlantic region from Cape Cod to Cape Fear, North Carolina (NOAA, 2020). Summer flounder grow quickly to more than 2 ft (60 cm) for males and 3 ft (90 cm) for females (NOAA, 2020). Summer flounder in the northern portion of the geographic range spawn and move offshore to depths of about 120 to 600 ft (35 to 185 m) (ASMFC, 2020). Summer flounder prefer sandy or muddy bottom habitats. Summer flounder eat a mixed diet of fish and invertebrates throughout their life, lying on the ocean floor concealed and ambushing prey that swim by (NOAA, 2020).

The summer flounder stock is managed jointly by NOAA Fisheries, ASMFC and the MAFMC under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan and Amendments. According to the 2019 stock assessment, summer flounder are not overfished and are not subject to overfishing (NOAA, 2020).

Known EFH for all life stages of summer flounder are found throughout the entire Offshore Project Area.

Eggs: The eggs of the summer flounder may be present in pelagic waters from the Gulf of Maine to Cape Hatteras. In general, summer flounder eggs are found between October and May, and are most abundant between Cape Cod and Cape Hatteras. Eggs may occur at depths of 33 to 360 ft (10 to 110 m) (MAFMC, 1998a).

Larvae: North of Cape Hatteras to the Gulf of Maine, larvae can be present from inshore bay and estuaries to the limits of the U.S. EEZ. In general, summer flounder larvae occur most abundantly nearshore (12 to 50 miles [20 to 80 km] from shore) at depths between 30 to 230 ft (9 to 70 m). They are most frequently found in the northern part of the Mid-Atlantic Bight from September to February, and in the southern part from November to May (MAFMC, 1998b).

Juveniles: North of Cape Hatteras to the Gulf of Maine, juveniles can be present from inshore bays and estuaries to the limits of the EEZ. In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37°F (3°C) and salinities from 10 to 30 ppt range (MAFMC, 1998b).

Adults: Adults move seasonally from inshore to offshore waters. Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant in the NOAA Estuarine Living Marine Resource (ELMR) database for the "mixing" and "seawater" salinity zones. Generally, summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore on the OCS at depths of 500 ft (152 m) in colder months.

Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. Local submerged aquatic vegetation mapping that may provide summer flounder HAPC is provided Figure 4-3. No eelgrass beds are expected to be present along the Brayton Point ECC or Landfalls. Eelgrass beds and macroalgae overlapping with summer flounder EFH may occur in or near proposed Project activities. Macroalgae is expected to occur seasonally (in warm water months) on exposed hard bottom surfaces. Hence, HAPC for summer flounder could occur in the Project Area in warmer months (May through October) due to the presence of macroalgae. As described in Section 3.1.3, areas with submerged aquatic vegetation in the area are limited.

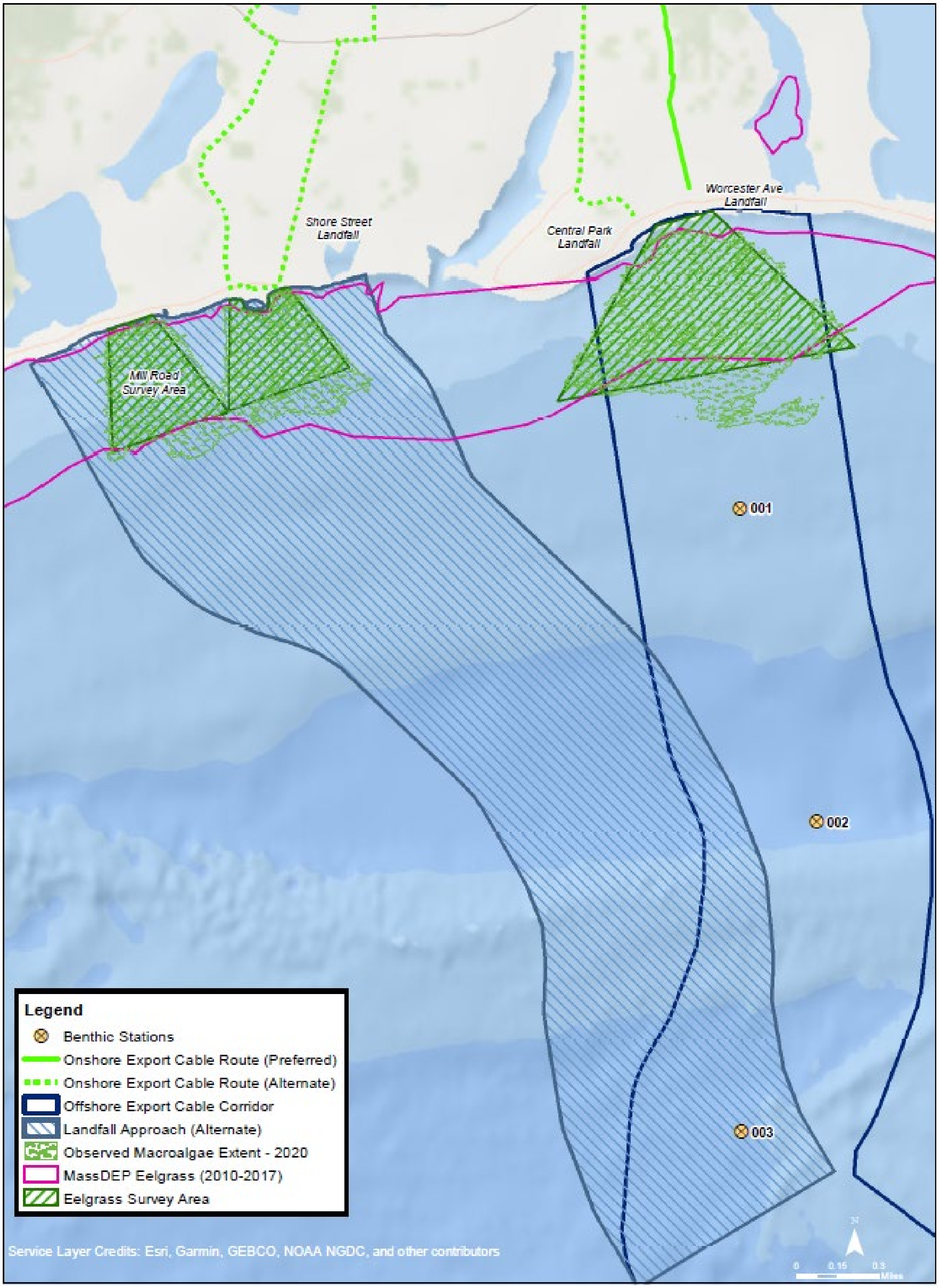


Figure 4-3. Mapped Eelgrass Beds at Falmouth Landfalls

4.3.1.19 White Hake

White hake is a member of the cod order that can grow up to 53 in (135 cm) and weigh up to 49 lb (22 kg) (NOAA, 2020). They are found from Newfoundland to southern New England (NOAA, 2020). White hake primarily prey on other bottom-dwelling organisms such as squid, crustaceans, and small bony fish.

There is a single stock of white hake, which according to the 2017 operational assessment is not overfished and is not subject to overfishing. White hake are part of the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). Juvenile white hake settle to the bottom and the adults prey primarily on other bottom-dwelling organisms such as squid, crustaceans, and small bony fish (NOAA, 2020).

White hake have known EFH for the adult life stage located in the Lease Area; EFH for larvae is found in the Falmouth ECC and Brayton Point offshore ECC; and EFH for the juvenile life stage is found in the Lease Area, Falmouth ECC and Brayton Point offshore ECC.

Larvae: EFH is identified for pelagic habitats in the Gulf of Maine, in southern New England, and on Georges Bank (NEFMC & NMFS, 2017). Early stage white hake larvae have been collected on the continental slope but cross the shelf-slope front and use nearshore habitats for juvenile nurseries. Larger larvae and pelagic juveniles have been found only on the continental shelf.

Juveniles: EFH is identified for intertidal and sub-tidal estuarine and marine habitats in the Gulf of Maine, on Georges Bank, and in southern New England, including mixed and high salinity zones in a number of bays and estuaries north of Cape Cod, to a maximum depth of 985 ft (300 m) (NEFMC & NMFS, 2017). Pelagic phase juveniles remain in the water column for about two months. In nearshore waters, essential fish habitat for benthic phase juveniles occurs on fine-grained, sandy substrates in eelgrass, macroalgae, and unvegetated habitats. In the Mid-Atlantic, most juveniles settle to the bottom on the continental shelf, but some enter estuaries, especially those in southern New England. Older YOY juveniles occupy the same habitat types as the recently-settled juveniles but move into deeper water (>165 ft [50 m]).

Adults: EFH is identified for sub-tidal benthic habitats in the Gulf of Maine, including depths greater than 80 ft (25 m) in certain mixed and high salinity zones portions of a number of bays and estuaries, between 330 and 1,310 ft (100 and 400 m) in the outer gulf, and between 1,310 and 2,950 ft (400 and 900 m) on the outer continental shelf and slope (NEFMC & NMFS, 2017). Essential fish habitat for adult white hake occurs on fine-grained, muddy substrates and in mixed soft and rocky habitats. Spawning takes place in deep water on the continental slope and in Canadian waters.

4.3.1.20 Windowpane Flounder

Windowpane flounder are found in the northwest Atlantic from the Gulf of St. Lawrence to Florida in relatively shallow water (NOAA, 2020). Adult windowpane flounder typically grow to 10 to 12 in (25 to 30 cm) in length. Young windowpane flounder usually feed on copepods that are suspended in the water column, while adult windowpane flounder typically prey on bottom-dwelling organisms such as shrimp, small fish, lobsters, and crabs (NOAA, 2020). Windowpane typically prefers sandy bottom habitats (Collette & Klein-MacPhee, 2002).

In Southern New England, they typically spawn during the spring and the fall (NOAA, 2020). There are two stocks of windowpane flounder in U.S. waters: Gulf of Maine/Georges Bank windowpane flounder, and Southern New England/Mid-Atlantic windowpane flounder. According to the 2017 operational assessment, the Gulf of Maine/Georges bank stock of windowpane flounder is overfished, while the Southern New England/Mid-Atlantic stock of windowpane flounder is not overfished and overfishing is not occurring (NOAA, 2020). Windowpane flounder are part of the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017).

Windowpane Flounder have known EFH for both juvenile and adult life stages throughout the Offshore Project Area, while egg and larval life stages can be found in all of the Offshore Project Area except for the Worcester Avenue/Central Park and Shore Street Landfalls.

Eggs and Larvae: The pelagic habitats on the continental shelf from Georges Bank to Cape Hatteras and in mixed and high salinity zones of coastal bays and estuaries throughout the region serve as EFH for the species' eggs and larvae (NEFMC & NMFS, 2017).

Juveniles: Intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to northern Florida, including mixed and high salinity zones in the bays and estuaries serve as EFH for juveniles of this species (NEFMC & NMFS, 2017). Juveniles of this flounder are found on mud and sand substrates that extend from the intertidal zone to a maximum depth of 200 ft (60 m). YOY have demonstrated a preference for mud substrates higher in sand.

Adults: EFH is identified for intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to Cape Hatteras, including mixed and high salinity zones in the bays and estuaries (NEFMC & NMFS, 2017). EFH for adult windowpane flounder is found on mud and sand substrates and extends from the intertidal zone to a maximum depth of 230 ft (70 m).

4.3.1.21 Winter Flounder

Winter flounder are found in estuaries and on the continental shelf of the Northwest Atlantic, from the Gulf of St. Lawrence, Canada to North Carolina (NOAA, 2020). They typically live 15 to 18 years and grow to more than 2 ft (60 cm) in length. Winter flounder feed on small invertebrates, shrimp, clams, and worms (NOAA, 2020). The name 'winter' flounder refers to their annual spawning migrations into nearshore waters in winter. Adults migrate in two phases; an autumn estuarine immigration prior to spawning, and a late spring/summer movement to either deeper, cooler portions of estuaries or to offshore areas after spawning (ASMFC, 2020). These flounder prefer muddy, sandy, cobbled, gravely, or boulder substrate in mostly nearshore environments (Pereira et al., 1999).

Winter flounder are managed in three different stocks: the Gulf of Maine, Georges Bank, and the Southern New England/Middle Atlantic which were most recently assessed in 2017 and 2019. The Georges Bank 2019 stock assessment found that stock is overfished, remains in a rebuilding plan, and is not subject to overfishing. The Southern New England/Mid-Atlantic 2017 stock assessment found that the stock is overfished, but is not subject to overfishing. However, the 2017 assessment for Gulf of Maine stock (the smallest stock) yielded results that were highly uncertain, and scientists were unable to determine an abundance estimate for this stock. Nevertheless, the assessment determined that the stock is not subject to overfishing (NOAA, 2020). Winter flounder are managed under the Northeast Multispecies Fishery Management Plan.

Winter flounder have known EFH for all life stages throughout the entire Offshore Project Area, with the exception of eggs, which are not found within the Lease Area.

Eggs: Sub-tidal estuarine and coastal benthic habitats from mean low water to 16 ft (5 m) from Cape Cod to Absecon Inlet, New Jersey (39 ° 22’ N), and as deep as 230 ft (70 m) on Georges Bank and in the Gulf of Maine, including mixed and high salinity zones in the bays and estuaries serves as EFH for eggs (NEFMC & NMFS, 2017). The eggs are adhesive, occur on a wide variety of bottom types, and are often observed from February to June, peaking in April on George Bank. Excessive sedimentation can reduce hatching success.

Larvae: EFH is identified for estuarine, coastal, and continental shelf water column habitats from the shoreline to a maximum depth of 230 ft (70 m) from Absecon Inlet, New Jersey to the Gulf of Maine and Georges Bank (including mixed and high salinity zones in the bays and estuaries) (NEFMC & NMFS, 2017). Larvae hatch in nearshore waters and estuaries or are transported shoreward from offshore spawning sites where they metamorphose and settle to the bottom as juveniles. Initially planktonic but become increasingly less buoyant as they grow and occupy the deeper depths in the water column with age.

Juveniles: EFH is identified for estuarine, coastal, and continental shelf benthic habitats from the Gulf of Maine to Absecon Inlet and including Georges Bank, and in mixed and high salinity zones in the bays and estuaries (NEFMC & NMFS, 2017). Essential fish habitat for juvenile winter flounder extends from the intertidal zone (mean high water) to a maximum depth of 200 ft (60 m). A variety of bottom types (e.g., mud, rocky substrates with attached macroalgae, and eelgrass, etc.) serve as suitable habitats. YOY juveniles are found inshore on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks. They prefer soft-sediment depositional areas where currents concentrate late-stage larvae. As they age the older individuals and disperse into coarser-grained substrates as they mature.

Adults: EFH is identified for estuarine, coastal, and continental shelf benthic habitats extending from the intertidal zone (mean high water) to a maximum depth of 230 ft (70 m) from Absecon Inlet to the Gulf of Maine including Georges Bank, and mixed and high salinity zones in the bays and estuaries (NEFMC & NMFS, 2017). Essential fish habitat for adult winter flounder occurs on muddy and sandy substrates, and on hard bottom on offshore banks. In inshore spawning areas, EFH includes a variety of substrates where eggs are deposited by adults on the bottom.

4.3.1.22 Witch Flounder

Witch flounder in the Western North Atlantic are distributed in deep, cold waters from Labrador to North Carolina (NOAA, 2020). Witch flounder, also known as grey sole, are slow-growing, late-maturing, and long-lived relative to other flatfish in the region. They can grow up to 25 in (63.5 cm). Adult witch flounder primarily feed on polychaete worms, but they also prey on other bottom-dwelling invertebrates such as sea cucumbers, small crustaceans, and small mollusks (NOAA, 2020). Witch flounder are present year-round and tend to concentrate near the southwest portion of the Gulf of Maine (Collette & Klein-MacPhee, 2002).

There is a single stock of witch flounder managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017). According to the 2017 operational assessment, witch flounder is overfished and it is unknown whether overfishing is occurring (NOAA, 2020).

Witch Flounder have known EFH for the egg life stage located within the Lease Area and the Brayton Point offshore ECC. EFH for larvae is found in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC. Juvenile life stage can be found in the Lease Area, while adults have known EFH in the Lease Area and Falmouth ECC.

Eggs and Larvae: EFH is identified for pelagic habitats on the continental shelf throughout the Northeast (NEFMC & NMFS, 2017). Witch flounder eggs are most often observed from March through October and larvae are most often observed from March through November, with peaks in May to July.

Juveniles: Sub-tidal benthic habitats are located between 160 and 1,310 ft (50 and 400 m) in the Gulf of Maine and as deep as 4,920 ft (1,500 m) on the outer continental shelf and slope, with mud and muddy sand substrates (NEFMC & NMFS, 2017).

Adults: Sub-tidal benthic habitats are located between 115 and 1,310 ft (35 and 400 m) in the Gulf of Maine and as deep as 4,920 ft (1,500 m) on the outer continental shelf and slope, with mud and muddy sand substrates (NEFMC & NMFS, 2017).

4.3.1.23 Yellowtail Flounder

Yellowtail flounder live along the Atlantic coast of North America from Newfoundland to the Chesapeake Bay. Yellowtail flounder grow faster than most flatfish, reaching up to 22 in (56 cm) in length and weighing 2.2 lb (1 kg) (NOAA, 2020). Spawning occurs in both inshore areas as well as on offshore banks in July (on Georges Bank).

There are three stocks in U.S waters: Gulf of Maine/Cape Cod, Georges Bank, and Southern New England/Mid-Atlantic stocks, all of which NOAA Fisheries is working to rebuild (NOAA, 2020). According to the 2019 stock assessment, the Southern New England/Mid-Atlantic stock of yellowtail flounder is overfished but not subject to overfishing and the Cape Cod/Gulf of Maine stock is not overfished but still rebuilding to the target level, and not subject to overfishing. The 2013 stock assessment of the Georges Bank stock indicates the stock is overfished and is subject to overfishing. Yellowtail flounder are managed under the Northeast Multispecies Fishery Management Plan (NEFMC & NMFS, 2017).

Yellowtail Flounder have known EFH for all life stages located in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Eggs: Coastal and continental shelf pelagic habitats are located in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic region, as far south as the upper Delmarva peninsula. The high salinity zones of the bays and estuaries also serve as EFH (NEFMC & NMFS, 2017). Eggs are most often observed during the months from mid-March to July, with peaks in April to June in southern New England.

Larvae: Coastal marine and continental shelf pelagic habitats in the Gulf of Maine, and from Georges Bank to Cape Hatteras, including the high salinity zones of the bays and estuaries provide EFH for larvae of this flounder species (NEFMC & NMFS, 2017). Larvae are most often observed from March through April in the New York Bight and from May through July in southern New England and southeastern Georges Bank.

Juveniles: Sub-tidal benthic habitats in coastal waters in the Gulf of Maine and on the continental shelf on Georges Bank and in the Mid-Atlantic, including the high salinity zones of the bays and estuaries provide EFH (NEFMC & NMFS, 2017). EFH for the species occurs on sand and muddy sand between 65 and 260 ft (20 and 80 m).

Adults: Sub-tidal benthic habitats in coastal waters in the Gulf of Maine and on the continental shelf on Georges Bank and in the Mid-Atlantic, including the high salinity zones of the bays and estuaries serve as the EFH for adult yellowtail flounder (NEFMC & NMFS, 2017). EFH for adults occurs on sand and sand with mud, shell hash, gravel, and rocks at depths between 80 and 300 ft (25 and 90 m).

4.3.2 Invertebrates

4.3.2.1 Atlantic Sea Scallop

Atlantic sea scallops are found in the Northwest Atlantic Ocean, from Newfoundland to Cape Hatteras, North Carolina (NOAA, 2020). The Atlantic sea scallop occurs along the continental shelf at depths ranging from approximately 60 to 360 ft (18 to 110 m) and is commonly found in seabed areas with low levels of suspended inorganic particles, including coarse substrates such as rock, gravels, or shells (Packer et al., 1999). Sea scallops feed by filtering phytoplankton or other small organisms out of the water column. Sea scallops can live up to 20 years, growing quickly for the first few years of their life, but typically do not grow larger than 6 in (15 cm) (NOAA, 2020).

Atlantic sea scallops spawn in September. While eggs are heavier than seawater, ocean currents may spread eggs and larvae around the region.

Atlantic sea scallops are managed under the Atlantic Sea Scallop Management Plan. The fishery primarily operates along the Atlantic coast from the Mid-Atlantic to the U.S./Canada border. The scallop fishery uses predominantly paired or single scallop dredges throughout the entire range of the fishery. To a lesser extent, and mainly in the Mid-Atlantic region, the fishery uses trawl gear. According to the 2018 stock assessment, Atlantic sea scallops are not overfished and are not subject to overfishing (NOAA, 2020).

Atlantic sea scallops have known EFH for all life stages located in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Eggs: EFH for scallops is primarily nearshore areas and on the continental shelf (NEFMC & NMFS, 2017), in the vicinity of adult scallops. Eggs tend to remain on or near the seafloor due to their density.

Larvae: EFH for scallop larvae is benthic and water column habitats of nearshore and offshore areas throughout the region (NEFMC & NMFS, 2017). Spat (free-swimming larval stage) will attach to hard surfaces including inorganic surfaces (e.g., pebble, gravel, etc.) or organic materials (e.g., macroalgae or other epifauna). Spat that have attached to these hard surfaces have greater chance of survival; spat that settle on sand generally do not survive.

Juveniles: EFH is identified for the hardbottom benthic habitats in the Gulf of Maine, on Georges Bank, and in the Mid-Atlantic in depths of approximately 60 to 360 ft (18 to 110 m). Juveniles (0.2 to 0.5 in [0.5 to 1.2 cm] shell height) use byssal threads to attach to hardbottom benthic habitats such as gravel, cobble, etc., leaving the original substrate on which they settle as spat. Juvenile scallops eventually lose their byssal attachment, become relatively active and may swim to escape predation. They can be carried long distances by currents. Dispersal increases with time, and older juveniles and adults tend to disperse more than young juveniles.

Adults: EFH for adult sea scallops is sand and hardbottom benthic habitats on Georges Bank, in the Gulf of Maine, and in the Mid-Atlantic (NEFMC & NMFS, 2017). Essential habitats for adult sea scallops are found primarily depths of approximately 60 to 360 ft (18 to 110 m), but have been noted in deeper sections of the

Gulf of Maine. Adult scallops occur together in masses (i.e., scallop beds). The permanence of the beds depends on habitat suitability, including the degree to which oceanic currents disperse larval stages. Adult scallops prefer cooler temperatures (50 to 59°F [10 to 15°C]) and higher salinity, avoiding inputs of freshwater.

4.3.2.2 Atlantic Surfclam

The Atlantic surfclam is the largest bivalve mollusk in the western North Atlantic, growing up to 8.9 in (22.6 cm) and living 35 years (NOAA, 2020). The species distribution includes sandy habitats along the continental shelf (Cargnelli et al., 1999b) ranging from the Gulf of St. Lawrence to Cape Hatteras (NOAA, 2020). Atlantic surfclams are suspension feeders on phytoplankton and use siphons which are extended above the surface of the substrate to pump in water (MAFMC, 2020b). Surfclams spawn in the summer and early fall. Spawning is not associated with temperature or temperature changes.

NOAA Fisheries, MAFMC, and state resource management agencies manage the Atlantic surfclam under the Surfclam-Ocean Quahog Fishery Management Plan and Amendments. The U.S. fishery generally concentrates on the populations off the coasts of New Jersey and the Delmarva Peninsula. According to the 2016 stock assessment the surfclam stock is not overfished and is not subject to overfishing (NOAA, 2020).

Atlantic surfclam have known EFH for the juvenile life stage located in the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, and Shore Street Landfall. Adult Atlantic surfclam have known EFH in the aforementioned areas and Brayton Point offshore ECC.

Juveniles and Adults: EFH is identified for throughout the substrate of sandy areas, to a depth of 3 ft (1 m) below the water/sediment interface. Suitable habitats occur within federal waters throughout the EEZ, from the eastern edge of Georges Bank and the Gulf of Maine. Surfclams may occur from the nearshore shallow beach zones to a depth of about 200 ft (650 m). Abundance diminishes at depths greater than 125 ft (38 m) (Cargnelli et al., 1999b).

4.3.2.3 Longfin Inshore Squid

Longfin inshore squid, also known as Loligo, are distributed in continental shelf waters located between Newfoundland and the Gulf of Venezuela, in the Northwest Atlantic Ocean, longfin squid are most abundant between Georges Bank and Cape Hatteras (NOAA, 2020). Migrations are south and offshore near the shelf edge during late fall through winter (generally October-March) and north and inshore during spring through early fall (generally April-September), following the sea temperatures. Longfin squid grow quickly up to a mantle length (large part of the squid in front of the head) of 1.6 ft (0.5 m), but usually measure less than 1 ft (30 cm). They have a short life span, reproducing right before they die at around six to eight months old. Spawning occurs in spring, and the majority of eggs hatch in mid-summer.

NOAA Fisheries and the MAFMC manage longfin squid as part of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and Amendments. The Northwest Atlantic population of longfin squid is managed as a single stock. According to the 2017 stock assessment, longfin squid are not overfished and the available information is insufficient to determine whether the stock is subject to overfishing (NOAA, 2020).

Known EFH for longfin squid are found in the entire Offshore Project Area for juvenile (pre-recruits) and adult (recruits) life stages. Additionally, the egg life stage of longfin squid have known EFH within the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, Shore Street Landfall, Brayton Point offshore ECC, and Sakonnet River ECC.

Eggs: EFH for eggs occurs in both inshore and offshore bottom habitats and ranges from Georges Bank to Cape Hatteras. Temperature is a driving factor with water temperatures between 50 and 73°F (10 and 23°C). Additionally, EFH have salinities between 30 and 32 ppt, and depth is less than 165 ft (50 m). Egg masses are demersal and can be found anchored to various substrates including rocks, boulders, shells, sand or mud bottom, as well as attached to aquatic vegetation (MAFMC, 2011).

Pre-recruits (≤ 3.1 in [8 cm]): EFH is identified for pelagic inshore and offshore waters of the continental shelf from the coast out to the limits of the EEZ. Pre-recruits EFH ranges from the Gulf of Maine through Cape Hatteras in areas that comprise the highest 75 percent of the catch where pre-recruit longfin squid were collected in the NEFSC trawl surveys. Generally, pre-recruit longfin squid are collected from shore to 700 ft (210 m) in temperatures between 39 and 81°F (4 and 27°C) (MAFMC, 2011).

Recruits (> 3.1 in [8 cm]): EFH is identified for the pelagic inshore and offshore waters of the Continental Shelf from the coast out to the limits of the EEZ. EFH ranges from the Gulf of Maine to Cape Hatteras in areas that comprise the highest 75% of the catch where recruited longfin squid were collected in the NEFSC trawl surveys. Generally, recruited longfin squid are collected from shore to 1,000 ft (300 m) and temperatures between 39 and 81°F (4 and 27°C) (MAFMC, 2011).

4.3.2.4 Ocean Quahog

The ocean quahog is a bivalve mollusk. While the highest concentrations of ocean quahogs are found south of Nantucket to the Delmarva Peninsula, the range of the mollusk includes the continental shelf from Newfoundland to Cape Hatteras (Cargnelli et al., 1999c, NOAA, 2020).

Ocean quahogs are among the longest-lived marine organisms in the world, living for 200 years or more (NOAA, 2020). They grow very slowly and do not start to reproduce until about six years old and do not reach a commercially harvestable size until after about 20 years (NOAA, 2020). Ocean quahogs are filter feeders and pump oxygen-filled water and food particles in through their siphons, which extend above the surface of the ocean floor. They feed on microscopic algae. The quahog prefers a medium to fine sandy bottom with mud and silt. Ocean quahogs reproduce very slowly but spawn from spring to fall with multiple annual spawning events.

NOAA Fisheries, MAFMC, and state resource management agencies manage the ocean quahog stock under the Atlantic Surfclam-Ocean Quahog Fishery Management Plan and Amendments. According to the 2017 stock assessment, the ocean quahog stock is not overfished and is not subject to overfishing (Cargnelli et al., 1999c). The U.S. fishery focuses on two regions: Maine and Long Island, New York.

Ocean quahogs have known EFH for juvenile and adult life stages located in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Juveniles and Adults: EFH is identified for substrate comprised of medium to fine sand, to a depth of 3 ft (1 m) below the water/sediment interface. The EFH for quahog is within federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90 percent of all the ranked 10-minute squares for the area where ocean quahogs were caught in the NEFSC surfclam and ocean quahog dredge surveys. Distribution in the western Atlantic ranges in depths from 30 ft (9 m) to about 800 ft (245 m). Ocean quahogs are found where bottom water temperatures do not exceed 60°F (16°C). Populations occur increasingly further offshore with distance, south from Cape Cod and Cape Hatteras (Cargnelli et al., 1999c).

4.3.2.5 Northern Shortfin Squid

Northern shortfin squid is a highly migratory, short-lived, marine species that inhabits the continental shelf and slope waters of the Northwest Atlantic Ocean, from Newfoundland to the central east coast of Florida. The lifespan of the shortfin squid is less than one year with mortality after spawning. Female shortfin squid range from 7 to 12 in mantle length, while males are 7 to 10.6 in (18 to 27 cm) in mantle length (NOAA, 2020). They can regulate their body color but are primarily orange-colored with a brown stripe that extends along the top side of the mantle. Shortfin squid are visual predators that eat crustaceans, fish, and other squid, including their own species.

NOAA Fisheries and the MAFMC manage shortfin squid as part of the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan and Amendments. According to the latest assessment, the shortfin squid is not subject to overfishing. There is currently not enough information to determine the population size (NOAA, 2020). In the northwest Atlantic Ocean, shortfin squid are most often caught along the continental shelf break in depths between 490 to 900 ft (150 to 275 m).

Known EFH for northern shortfin squid for the adult life stage is located in the Brayton Point offshore ECC, Falmouth ECC, Worcester Avenue/Central Park Landfall, and Shore Street Landfall.

Recruits (> 4 in [10 cm] adults): EFH is identified for the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina in areas that comprise the highest 75 percent of the catch where recruited shortfin squid were collected in the NEFSC trawl surveys. Generally, recruited shortfin squid are collected from shore to 600 ft (180 m) and temperatures between 39 and 66°F (4 and 19°C) (MAFMC, 2011).

4.3.3 Skates

Note that there are no egg or larval EFH designations for any of the skate species. This is because egg case distributions and habitat associations are not well understood, and since they emerge from their egg cases as fully developed juveniles, there is no larval stage (NEFMC & NMFS, 2017).

4.3.3.1 Barndoor Skate

The barndoor skates are one of the largest skates found in the North Atlantic Ocean from Newfoundland and the southern side of the Gulf of St. Lawrence south to North Carolina. They can reach a size of 5 ft (1.5 m) and 44 lb (20 kg) (Oceana, 2020). Like most skates and rays, they live on the seafloor, where they hunt a variety of invertebrate and fish prey.

The Northeast skate complex fishery in the Greater Atlantic Region includes seven skate species, including barndoor skate and six other skate species (winter skate, little skate, rosette skate, smooth skate, clearnose skate, and thorny skate) (NOAA, 2020). The Northeast skate fishery operates from Maine to Cape Hatteras, North Carolina; from inshore to offshore waters on the edge of the continental shelf (NOAA, 2020). The primary target skates in the fishery are winter and little skates, but barndoor skates are also fished. Skate is mostly harvested incidentally in trawl and gillnet fisheries targeting groundfish, monkfish, and sometimes scallops. The Northeast Skate Complex Fishery Management Plan is managed by the NEFMC, with NOAA Fisheries serving as the implementing body for rules and regulations within the fishery (NEFMC & NMFS, 2017). Skate is mostly harvested incidentally in trawl and gillnet fisheries targeting groundfish, monkfish, and sometimes scallops. The barndoor skate is not considered to be overfished.

Barndoor skate have known EFH for juveniles and adults located in the Lease Area.

Juveniles and Adults: EFH for both life stages is benthic habitats on the continental shelf in depths of 130 to 1,310 ft (40 to 400 m) on Georges Bank and in southern New England. EFH for adults also occurs on the continental slope in depths to 2,460 ft (750 m) (NEFMC & NMFS, 2017). EFH for juvenile and adult barndoor skates includes a range of substrate, including mud, sand, and gravel.

4.3.3.2 Little Skate

The little skate is a demersal species found primarily in the Mid-Atlantic Bight and on Georges Bank, but has a range that includes Nova Scotia to Cape Hatteras, North Carolina. Its preferred substrate habitat is sandy or pebbly bottom, but it may be is also found on ledges and in mud (Collette & Klein-MacPhee, 2002). The little skate may tolerate a wide range of temperatures (Packer et al., 2003a), and as such, is found throughout the year in New England waters. The average female little skate spawns twice per year, once in the spring and once in the fall (Packer et al., 2003a). The majority of fully or partially developed egg cases are found from late October to January and from June to July.

As mentioned above, the Northeast skate complex fishery in the Greater Atlantic Region includes seven skate species, including little skate (NOAA, 2020). The skate fishery operates from Maine to Cape Hatteras, North Carolina and from inshore to offshore waters on the edge of the continental shelf (NOAA, 2020). The Northeast Skate Complex Fishery Management Plan is managed by the NEFMC, with NOAA Fisheries serving as the implementing body for rules and regulations within the fishery (NEFMC & NMFS, 2017). The little skate is not considered to be overfished.

Little skate have known EFH for juveniles and adults located within the entire Offshore Project Area.

Juveniles: EFH for juvenile little skates occurs on sand and gravel substrates but is also found on mud. Habitat includes intertidal and sub-tidal benthic habitats in coastal waters of the Gulf of Maine and on

Georges Bank, extending to a maximum depth of 260 ft (80 m). EFH extends to the Mid-Atlantic region as far south as Delaware Bay, including high salinity zones in the bays and estuaries (NEFMC & NMFS, 2017).

Adults: EFH for adult skate is similar to juvenile EFH. It includes intertidal and sub-tidal benthic habitats in the same coastal waters, but can extend deeper, to a maximum depth of 330 ft (100 m) (NEFMC & NMFS, 2017). EFH for adult little skates occurs on mud, sand and gravel substrates.

4.3.3.3 Winter Skate

The winter skate is found from the Gulf of St. Lawrence in Canada to Cape Hatteras, North Carolina (NOAA, 2020). Populations are generally concentrated on Georges Bank and the northern section of the Mid-Atlantic Bight (Packer et al., 2003b). Winter skates have large bodies growing up to 5 ft (1.5 m) in length. They can live for about 20 years, reproducing when they are about 11 years old and 2.5 ft long (0.75 m) (NOAA, 2020). Skates feed on a variety of organisms such as crustaceans, mollusks, worms, squid, and fish.

As mentioned above, the Northeast skate complex fishery in the Greater Atlantic Region includes seven skate species, including winter skate (NOAA, 2020). The skate fishery operates from Maine to Cape Hatteras, North Carolina; from inshore to offshore waters on the edge of the continental shelf (NOAA, 2020). Winter skates are the primary species harvested for human consumption, for the meat in their wings. (NOAA, 2020). According to the 2019 stock assessment, winter skate are not overfished and are not subject to overfishing.

Winter skate have known EFH for juvenile and adult stages within the entire Offshore Project Area.

Juveniles: EFH is identified for coastal waters and sub-tidal benthic habitats in coastal waters from the shoreline to a maximum depth of 295 ft (90 m), including the high salinity zones of the bays and estuaries (NEFMC & NMFS, 2017). The range extends from Georges Bank and eastern Maine to Delaware Bay. Essential fish habitat for juvenile winter skates occurs on substrates including mud, sand and gravel.

Adults: EFH for adult winter skate is very similar to juveniles. Adults occur from the shoreline to a maximum depth of 260 ft (80 m), including the high salinity zones of the bays and estuaries (NEFMC & NMFS, 2017). Essential fish habitat for adult winter skates includes mud, sand and gravel.

4.3.4 Highly Migratory Species

4.3.4.1 Albacore Tuna

Albacore tuna is a pelagic species that is found globally. Albacore tuna grow relatively quickly, up to more than 4 ft (1.2 m) and 88 lb (40 kg) (NOAA, 2020). Albacore tuna feed near the top of the food chain, preying upon a variety of fish, crustaceans, and squid. They live in tropical and warm temperate waters in the Atlantic, Pacific, and Indian Oceans. In the Atlantic, they are found from Nova Scotia to northern Argentina, and from Ireland to South Africa (NOAA, 2020).

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the North Atlantic albacore tuna fishery in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. According to the 2016 stock assessment, North Atlantic albacore tuna are not overfished, have rebuilt to target population levels, and are not subject to overfishing (NOAA, 2020).

Albacore tuna have known or presumed EFH for spawning, eggs, and larvae in the Lease Area and Falmouth ECC. Juvenile albacore tuna have known EFH in the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, Shore Street Landfall, Brayton Point offshore ECC, and Sakonnet River ECC. Adult life stages are located in the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, Shore Street Landfall, and Brayton Point offshore ECC,

Spawning, Eggs, and Larvae: At this time, available information is insufficient for the identification of EFH for this life stage within the U.S. EEZ (NMFS, 2017).

Juveniles (<35.5 in [<90 cm] fork length [FL]): EFH is identified for offshore, pelagic habitats of the Atlantic Ocean. The range includes the outer edge of the U.S. EEZ through Georges Bank, south of Cape Cod, to Cape Hatteras, North Carolina (NMFS, 2017).

Adults (>35.5 in [>90 cm] FL): EFH identified for adults is the same as for juvenile EFH (NMFS, 2017).

4.3.4.2 Basking Shark

The basking shark is the second largest fish in the world (NOAA, 2006). It is a filter-feeding plankton eater with a wide temporal and spatial range in both the northwestern and eastern Atlantic. Seasonal water stratifications, temperature, and prey abundance may influence the range of the shark (NMFS, 2009). Basking sharks are most often observed off the Atlantic coast in the winter season but can also be found in spring and fall. Very little is known about basking shark reproductive processes.

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the basking shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. The basking shark is listed as “vulnerable” in the International Union for the Conservation of Nature Red List of Threatened Species and in Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Fishing for basking sharks is prohibited in U.S. waters (NMFS, 2009).

The basking shark has known EFH for neonate/YOY, juvenile and adult life stages located in the Lease Area, Falmouth ECC and Brayton Point offshore ECC.

Neonate/YOY: At this time, available information is insufficient for the identification of EFH for this life stage (NMFS, 2009).

Juveniles and Adults: EFH designation for juveniles and adults are considered the same and includes the Atlantic east coast from the northern Outer Banks of North Carolina to the Gulf of Maine (NMFS, 2009), including south of Martha’s Vineyard and Nantucket.

4.3.4.3 Blue Shark

The blue shark is one of the world’s most wide-ranging sharks. The blue shark is pelagic and prefers deep, clear, blue waters with temperatures ranging from 50 to 68°F (10 to 20°C) and is known to be found in temperate to tropical waters (NMFS, 2009). Squid are important prey for blue sharks, but their diet includes other invertebrates, such as cuttlefish and pelagic octopuses, as well as crustaceans, a large number of bony fish, small sharks, mammalian carrion, and occasional sea birds.

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the blue shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. Although finning is now prohibited in U.S. waters, blue sharks were historically finned and discarded because of the low value of their flesh. Large numbers of blue sharks are caught and discarded yearly in pelagic tuna and swordfish fisheries. The blue shark is one of the most abundant large vertebrates in the world, yet it may be vulnerable to overfishing because it is caught in tremendous numbers as bycatch in numerous longline fisheries.

EFH for blue shark for neonate/YOY, juvenile, and adult life stages is located within the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Neonates/YOYs (≤30 in [≤76 cm] FL): EFH includes offshore Atlantic Ocean from Cape Cod to New Jersey. EFH generally follows the continental shelf south of Georges Bank to the outer extent of the U.S. EEZ in the Gulf of Maine (NMFS, 2017).

Juveniles (30 to 73 in [77 to 184 cm] FL) and Adults (≥ 73 in [≥185 cm] FL): EFH includes areas of the Atlantic Ocean in the Gulf of Maine and Georges Bank south Florida (NMFS, 2017).

4.3.4.4 Bluefin Tuna

In the western Atlantic, bluefin tuna are found from Newfoundland to the Gulf of Mexico (NOAA, 2020). Atlantic bluefin tuna are managed as distinct western and eastern stocks separated by a management boundary at the 45°W meridian. In the western North Atlantic, bluefin tuna range from 45°N to 0° (NMFS, 2009). Bluefin tuna migrate from their spawning ground in the Gulf of Mexico in the spring, moving north into

New England and Canada through the summer and the beginning of fall. In June, they can be found off the coast of southern New England and New Jersey (Collette & Klein-MacPhee, 2002). Bluefin tuna may inhabit the near surface water to 300 ft (91 m) deep. Atlantic bluefin tuna typically hunt small fish such as sardines, herring, and mackerel, and invertebrates, such as squid and crustaceans.

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the Western Atlantic bluefin tuna fishery in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. The 2017 stock assessment indicates that the Western Atlantic bluefin tuna stock is not subject to overfishing. Based on the information in the 2017 stock assessment, NOAA Fisheries has determined that the western Atlantic bluefin tuna stock has an unknown overfished status.

Bluefin tuna have known EFH for juvenile life stage within the Lease Area, Falmouth ECC, Brayton Point offshore ECC, the Sakonnet River ECC, Worcester Avenue/Central Park Landfall, and Shore Street Landfall. The adult life stage of the bluefin tuna can be found in the Lease Area, Falmouth ECC, Brayton Point offshore ECC, Worcester Avenue/Central Park Landfall, and Shore Street Landfall

Juveniles (<73 in [<185 cm] FL): EFH is identified for the coastal and pelagic habitats of the Mid-Atlantic Bight and the Gulf of Maine. The habitat ranges from southern Maine to Cape Lookout and includes the shore (excluding Long Island Sound, Delaware Bay, Chesapeake Bay, and Pamlico Sound) to the continental shelf break, where it follows the outer extent of the U.S. EEZ to Cape Lookout. On Cape Cod, EFH are located in the coastal water from the Great South Passage to shore. EFH is associated with certain environmental conditions in the Gulf of Maine (61 to 66°F [16 to 19°C]; 0 to 131 ft [0 to 40 m] deep). EFH in other locations is associated with temperatures ranging from 39 to 79°F (4 to 26°C), often in depths of less than 66 ft (20 m) but can be found in waters that are 130 to 330 ft (40 to 100 m) in depth in winter (NMFS, 2017).

Adults (≥73 in [≥185 cm] FL): EFH is identified in offshore and coastal regions of the Gulf of Maine the mid-coast of Maine to Massachusetts; on Georges Bank; offshore pelagic habitats of southern New England; from southern New England to coastal areas between the mouth of Chesapeake Bay and Onslow Bay, North Carolina; from coastal North Carolina south to the outer extent of the U.S. EEZ (NMFS, 2017).

4.3.4.5 Common Thresher Shark

The common thresher shark is found in both cool and warm waters from coastal to oceanic habitats (NOAA, 2009). In the northwest Atlantic Ocean, they range from Newfoundland to Cuba (NOAA, 2020). They are aggressive predators that feed near the top of the food chain on schooling fish such as herring and mackerel and occasionally on squid and seabirds (NOAA, 2020). Common thresher sharks live a long time (19 to 50 years), reproduce late in life, and have only a few young at a time (NOAA, 2020).

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the thresher shark in the U.S. under the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. Atlantic common thresher sharks have never been assessed and the population status is unknown. The fishing rate has been kept at the recommended level (NOAA, 2020).

The common thresher shark has known EFH for all life stages in the Lease Area, Falmouth ECC, Brayton Point offshore ECC, Worcester Avenue/Central Park Landfall, and Shore Street Landfall.

Neonate/YOY, Juveniles, and Adults: Insufficient data are available to differentiate size classes EFH; therefore, EFH is presumed to be the same for all life stages. EFH includes the Atlantic Ocean, from the offshore extent of the U.S. EEZ boundary at Georges Bank to Cape Lookout, North Carolina; and from Maine to locations offshore of Cape Ann, Massachusetts (NMFS, 2017).

4.3.4.6 Dusky Shark

The range of the dusky shark includes warm and temperate coastal waters in the Atlantic, Pacific, and Indian Oceans (NOAA, 2009). The dusky shark shows little selection between inshore waters and the deeper waters along the continental shelf edge. Adult dusky sharks have a broad and varied diet, consisting mostly of bony fish, sharks, rays, and cephalopods.

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the dusky shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. The dusky shark used to be important as a commercial species and a game fish, but fishing is currently prohibited (NMFS, 2017).

The dusky shark has known EFH for all life stages in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Neonate/YOY (≤38.5 in [≤98 cm] FL): EFH in the Atlantic Ocean includes offshore water from southern New England to Cape Lookout, North Carolina. EFH can be defined with warm and relatively shallow habitat conditions that include temperatures from 65 to 72°F (18.1 to 22.2°C), salinities of 25 to 35 ppt and depths at 14 to 51 ft (4.3 to 15.5 m). EFH for this life stage in the Atlantic is to approximately 195 ft (60 m) in depth (NMFS, 2017).

Juveniles and Adults (>38.5 in [>98 cm] FL): EFH is identified along the Atlantic east coast and pelagic waters inshore of the continental shelf break (< 656 ft [200 m] in depth). This includes the offshore habitats of southern Cape Cod to Georgia and adjacent pelagic habitats. Inshore extent for these life stages is the 66 foot (20 m) bathymetric line, except in habitats of southern New England, where EFH is extended seaward of Martha's Vineyard. The pelagic habitats of southern Georges Bank and adjacent continental shelf break from Nantucket Shoals and the Great South Channel to the eastern boundary of the U.S. EEZ. Adults are generally found deeper (up to 6,560 ft [2,000 m]) than juveniles; however, there is overlap in the habitats utilized by both life stages.

4.3.4.7 Porbeagle Shark

The porbeagle shark is a lamnid shark common in deep, cold temperate waters of the North Atlantic, South Atlantic, and South Pacific Oceans and is valued as food. It is primarily an opportunistic piscivore with a diet characterized by a wide range of species.

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the porbeagle shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. Whether the porbeagle sharks in the North Atlantic constitute one or more separate stocks is not known (NMFS, 2009). A small porbeagle shark fishery resumed in the early 1990s in the northeastern U.S., after being practically non-existent for decades. Intensive fisheries have depleted the stocks of porbeagle sharks in a few years wherever they have existed, demonstrating that the species cannot withstand heavy fishing pressure. This species was determined to be overfished with no overfishing occurring in 2007 (November 7, 2007, 71 Federal Register 65086).

Porbeagle shark have known EFH for all life stages located in the Lease Area.

Neonate/YOY, Juveniles, and Adults: At this time, available information is insufficient for the identification of EFH by life stage, therefore all life stages are combined in the EFH designation. EFH in the Atlantic Ocean includes offshore and coastal waters of the Gulf of Maine (not including Cape Cod Bay and Massachusetts Bay) and offshore waters of the Mid-Atlantic Bight from Georges Bank to New Jersey (NMFS, 2017).

4.3.4.8 Sand Tiger Shark

The sand tiger shark is a large, coastal species found in tropical and warm temperate waters throughout the world, often found in very shallow water (about 13 ft [4 m]) (NMFS, 2009). They hunt nocturnally preying mainly on fish. In North America they are rarely encountered north of the Mid-Atlantic Bight. The species has been fished for its flesh and fins in coastal longline fisheries, although possession of this species in Atlantic waters of the U.S. is now prohibited. In the northwestern Atlantic, mature sand tiger males and juveniles occur between Cape Cod and Cape Hatteras while mature and pregnant females inhabit the more southern waters between Cape Hatteras and Florida (NMFS, 2009).

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the sand tiger shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. The species is extremely vulnerable to overfishing because it congregates in coastal areas in large numbers during the mating season. These aggregations are attractive to fishermen, although the effects of fishing these aggregations may contribute to local declines in the population abundance. In 1997, NMFS prohibited possession of this species in U.S. Atlantic waters (NMFS, 2009).

Sand Tiger Sharks have known EFH for larval/neonate/YOY and juvenile life stages located in the entire Offshore Project Area.

Larvae/Neonate/YOY (≤43 in [≤109cm] FL) and Juveniles (43 to 76.5 in [109 to 193 cm] FL): Neonate EFH ranges from Massachusetts (the Plymouth, Kingston, Duxbury (PKD) bay system) to Florida and includes Sandy Hook and Narragansett Bays as well as coastal sounds, the lower Chesapeake Bay, Delaware Bay (and adjacent coastal areas), Raleigh Bay, and habitats near Cape Hatteras. Juvenile EFH is similar to neonate and includes habitats between Massachusetts and New York (notably the PKD bay system), and between mid-New Jersey and the mid-east coast of Florida. In general, EFH is where temperatures range from 66 to 81°F (19 to 27°C), salinities range from 23 to 31 ppt at depths of 9 to 45 ft (2.8 to 13.7 m) in rocky substrate, sand and mud areas (NMFS, 2017).

4.3.4.9 Sandbar Shark

The sandbar shark occurs in subtropical and warm temperate waters. The North Atlantic population ranges from Cape Cod to the western Gulf of Mexico (NMFS, 2009). As the name implies, the sandbar shark prefers bottom habitats. It is found most commonly in 65 to 180 ft (20 to 55 m) of water, but occasionally found at depths of about 650 ft (200 m). The sandbar shark preys on fish, rays, and crabs.

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the sandbar shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. Stock assessments in 2006 indicated that the stock was overfished with overfishing occurring. As a result, in 2008 NMFS implemented Amendment 2 to the Consolidated HMS FMP, which led to reduced fishing mortality in sandbar sharks. Currently, the only directed fishing authorized on sandbar sharks is under the auspices of the shark research fishery. Sandbar sharks are also prohibited from retention in the recreational fishery. The species is considered highly vulnerable to overfishing because of its slow maturation and heavy fishing pressure (NMFS, 2009).

The sandbar shark has known EFH for juvenile and adult life stages in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Juveniles (26 to 61 in [67 to 154 cm] FL): EFH includes coastal sections of the Atlantic Ocean between Nantucket Sound, Massachusetts and Georgia, where water temperatures range from 68 to 75°F (20 to 24°C) and depths range from 7.9 to 21 ft (2.4 to 6.4 m). Important nurseries include the bays where neonate/YOY EFH occurs (NMFS, 2017).

Adults (> 61 in [154 cm] FL): EFH in the Atlantic Ocean includes coastal areas from southern New England to the Florida Keys, ranging from inland waters of Delaware Bay and the mouth of Chesapeake Bay to the continental shelf break (NMFS, 2017).

4.3.4.10 Shortfin Mako Shark

The shortfin mako shark is an oceanic species ranging across warm and warm-temperate waters around the world (NMFS, 2009). Off the east coast, Atlantic shortfin mako sharks are found from New England to Florida, in the Gulf of Mexico from Florida to Texas, and in the Caribbean Sea (NOAA, 2020). Shortfin mako sharks are aggressive predators that feed near the top of the food web on marine fish such as bluefish, swordfish, tuna, marine mammals, and other sharks.

The shortfin mako is targeted as a game fish and is a common bycatch in tuna and swordfish fisheries. Shortfin makos are usually the only sharks retained in pelagic fleets with high shark bycatch rates because they have high market value (NMFS, 2009). It is managed by the Atlantic Highly Migratory Species Division of NOAA Fisheries under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006). According to the 2017 stock assessment, shortfin mako sharks are overfished and subject to overfishing (NOAA, 2020). Based on the 2017 stock assessment and new International Commission for the Conservation of Atlantic Tuna requirements, NOAA Fisheries implemented regulations to require the live release of shortfin mako sharks taken in fishing nets and restricts commercial retention to shortfin makos that are dead when pulled onboard the fishing vessel (i.e., at haul back).

At this time, available information is insufficient for the identification of EFH by life stage, therefore all life stages are combined in the EFH designation. The shortfin mako shark has known EFH for all life stages located in the Lease Area, Falmouth ECC, and Brayton Point offshore ECC.

Neonate/YOY (≤ 50.5 in [128 cm] FL), Juveniles (50.5 to 108 in [129 to 274 cm]FL), and Adults (≥ 108 in [275 cm]FL): EFH in the Atlantic Ocean includes pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) to Cape Cod (seaward of the 656 foot [200 m] bathymetric line); coastal and offshore habitats between Cape Cod and Cape Lookout, North Carolina; and localized habitats off South Carolina and Georgia (NMFS, 2017).

4.3.4.11 Skipjack Tuna

The skipjack tuna is found around the world in tropical and warm-temperate waters, generally limited by the 59°F (15°C) isotherm. In the western Atlantic skipjack range as far north as Newfoundland and as far south as Brazil (NMFS, 2009). Skipjack tuna are opportunistic and prey upon fish, cephalopods and crustaceans (NMFS, 2017). Skipjack tuna are an epipelagic and oceanic species that can be found at depths of 850 ft (260 m).

Skipjack tuna are commercially and recreationally important and are typically caught using surface gear. Currently, the overfishing status of this tuna is unknown (NMFS, 2009). Skipjack tuna prefer convergence zones where oceanic surface waters come together and tend to associate with birds, drifting objects, whales, and sharks. The NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the skipjack tuna in the U.S. under the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006).

Skipjack tuna have known EFH for the adult life stage located in the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, Shore Street Landfall, Brayton Point offshore ECC, and Sakonnet River ECC; EFH for the juvenile life stage is located in the Lease Area and Falmouth ECC.

Juveniles (≤18 in (45 cm) FL): EFH in the Atlantic Ocean is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank (off Massachusetts) and coastal and offshore habitats between Massachusetts and South Carolina. Juveniles are found in waters greater than 65 ft (20 m) (NMFS, 2017).

Adults: (≥18 in [≥45 cm] FL): EFH in the Atlantic Ocean is coastal and offshore habitats between Massachusetts and Cape Lookout, North Carolina and localized areas in the Atlantic off South Carolina. Georgia, and the northeast coast of Florida (NMFS, 2017).

4.3.4.12 Smoothhound Shark

The smoothhound shark complex consists of three species, smooth dogfish, Florida smoothhound (*Mustelus norrisi*), and Gulf smoothhound (*Mustelus sinusmexicanus*). Smooth dogfish is the only smoothhound shark complex species found in the Atlantic (NMFS, 2017) Therefore, all EFH identified in the Atlantic is exclusively for smooth dogfish. Smooth dogfish is a common coastal shark species found in the Atlantic Ocean from Massachusetts to northern Argentina (NMFS, 2017). They are primarily demersal sharks that inhabit continental shelves. They are typically found in inshore waters down to 650 ft (200 m) depth. The maximum size limit for smooth dogfish is typically 60 in (150 cm) TL. Smooth dogfish prey mainly on crustaceans, polychaetes, and mollusks.

There are two regional stocks of smooth dogfish, the Atlantic and Gulf of Mexico stock complexes (NMFS, 2017). NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the smooth dogfish in the U.S. under the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006).

Available information is insufficient at this time for the identification of EFH for all life stages. Therefore, all life stages are combined in the EFH designation. The smoothhound shark complex has known EFH for all life stages located in the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, Shore Street Landfall, Brayton Point offshore ECC, and Sakonnet River ECC.

Neonate/YOY, Juveniles, and Adults: Smooth dogfish EFH in the Atlantic Ocean includes coastal areas ranging from Cape Cod Bay, Massachusetts to South Carolina, inclusive of inshore bays and estuaries (e.g., Pamlico Sound, Core Sound, Delaware Bay, Long Island Sound, Narragansett Bay, etc.). EFH also includes continental shelf habitats between southern New Jersey to Cape Hatteras, North Carolina (NMFS, 2017).

4.3.4.13 Tiger Shark

The tiger shark is a highly migratory, pelagic shark found in warm waters of deep oceanic and shallow coastal regions. The tiger shark is one of the larger species of sharks, reaching over 18 ft (5.5 m) TL and over 1,985 lb (900 kg) (NMFS, 2017). The tiger shark is a solitary, primarily nocturnal hunter and with a wide range of prey including crustaceans, fish, seals, birds, squid, turtles, sea snakes, dolphins and other smaller sharks.

Tiger sharks have been known to make transoceanic migrations and prefer coastal and offshore waters from approximately 40 to 0 °N (in the Western Atlantic from New Jersey/Pennsylvania to the equator). They rarely occur north of the Mid Atlantic Bight. Nurseries for the tiger shark have not been well documented but appear to be in offshore areas. Although specific pupping areas have not been identified, Neonate sharks have been caught frequently in the northern portion of the Gulf of Mexico (NOAA, 2009).

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the tiger shark in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006).

Tiger Shark have known EFH for juvenile and adult life stages located in the Lease Area and Falmouth ECC. The species has been historically present in Massachusetts waters. There is evidence that the species uses Massachusetts coastal waters for secondary nursery habitat (Skomal, 2007).

Juveniles (40-105 in [102 - 266 cm]FL) and Adults (>105 in [266 cm] FL): EFH in the Atlantic Ocean extends from offshore pelagic habitats associated with the continental shelf break at the seaward extent of the U.S. EEZ boundary (south of Georges Bank, off Massachusetts) to the Florida Keys, inclusive of offshore portions of the Blake Plateau (NMFS, 2017).

4.3.4.14 White Shark

The white shark is the largest of the lamnid, or mackerel, sharks. It is a poorly known apex predator that preys upon fish, marine mammals, and seabirds. It occurs within all temperate and tropical belts of ocean in coastal and offshore waters (NMFS, 2017). It is most common in cold and warm temperate seas, and its presence is usually sporadic throughout its range. In the western North Atlantic, it is found from Newfoundland to the Gulf of Mexico. Due to the shark's sporadic presence, very little is known about its breeding habits. Sightings of the white shark in the Mid Atlantic Bight occur from April to December. The white shark prefers open ocean habitat.

In U.S. waters, white sharks are targeted in a catch-and-release-only recreational fishery, as possession of the species is prohibited (NOAA, 2009). The white shark is managed through the Atlantic Highly Migratory Species Division of NOAA Fisheries under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006).

White Shark have known EFH for neonate life stages located in the entire Offshore Project Area, with the exception of the Brayton Point Landfalls. Juvenile and adult life stages of white shark can be found in the Lease Area, Falmouth ECC, Worcester Avenue/Central Park Landfall, Shore Street Landfall, and Brayton Point offshore ECC.

Neonate/YOY (<62.5 in [159 cm] FL): EFH includes inshore waters out to 65 miles (105 km) from Cape Cod, Massachusetts, to an area offshore of Ocean City, New Jersey (NMFS, 2017).

Juveniles (62.5 to 164.5 in [160 to 418 cm] FL) and Adults (> 164.5 in [418 cm] FL: Known EFH includes inshore waters to habitats 65 miles (105 km) from shore, in water temperatures ranging from 48 to 82°F (9 to 28°C), but more commonly found in water temperatures from 57 to 73°F (14 to 23°C) from Cape Ann, Massachusetts, including parts of the Gulf of Maine, to Long Island, New York, and from Jacksonville to Cape Canaveral, Florida (NMFS, 2017).

4.3.4.15 Yellowfin Tuna

Yellowfin tuna are found near the surface of tropical and subtropical oceans around the world (NOAA, 2020). The population ranges from the central region of the Gulf of Mexico from Florida to Southern Texas and from the mid-east coast of Florida and Georgia to Cape Cod, and south of Puerto Rico. Yellowfin prefer the upper 40 in (100 cm) of the water column in open ocean. Yellowfin tuna travel in schools and feed near the top of the food chain on fish, squid, and crustaceans. Spawning occurs throughout the year between 15°N and 15°S latitude. Yellowfin tuna grow fairly fast, up to 400 lb (180 kg), and have a somewhat short life span of about seven years (NOAA, 2020).

NOAA Fisheries, through the Atlantic Highly Migratory Species Division, manage the yellowfin tuna as a single stock in the U.S. under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2006) and amendments. According to the 2019 stock assessment, Atlantic yellowfin tuna are not overfished and not subject to overfishing (NOAA, 2020). Yellowfin tuna are considered a commercially and recreationally important target species and are caught with purse seine, troll, handline, and longline gear (NOAA, 2009).

Yellowfin Tuna have known EFH for the juvenile life stage located in the entire Offshore Project Area, except for the Brayton Point Landfall. Adult life stage EFH is located within the Lease Area and the Brayton Point offshore ECC.

Juveniles (< 42.5 in [108 cm] FL): EFH in the Atlantic Ocean is offshore pelagic habitats seaward of the continental shelf break between the seaward extent of the U.S. EEZ boundary on Georges Bank and Cape Cod, Massachusetts. Offshore and coastal habitats in the Atlantic Ocean from Cape Cod, Massachusetts to the mid-east coast of Florida and the Blake Plateau (NMFS, 2017).

4.3.5 Habitat Areas of Particular Concern

HAPCs are a subset of designated EFH that is especially important ecologically to a species/life stage and/or is vulnerable to degradation, as described in Section 4.1. There is HAPC for inshore juvenile Atlantic cod and for adult and juvenile summer flounder identified in the Project Area.

4.3.5.1 Inshore Juvenile Cod HAPC

The NEFMC recognized the importance of inshore areas to juvenile Atlantic cod, especially along the coastal areas of the Gulf of Maine and Southern New England with structurally complex rocky-bottom habitat that supports a wide variety benthic fauna. These habitats are not rare; however, they do provide protection from predation and provide readily available prey species for juvenile cod (NEFMC, 2017).

Recognizing the importance of this habitat type, in 1999, the NEFMC voted to approve an alternative and include the HAPC in the next appropriate fishery management plan amendment. The alternative defines the inshore areas of the Gulf of Maine and Southern New England between 0 to 65 ft (0 to 20 m), relative to mean high water (NEFMC, 2017). This HAPC for juvenile cod is identified Figure 4-2.

4.3.5.2 Adult and Juvenile Summer Flounder HAPC

Local seagrass and macroalgae mapping provided in COP Appendix K, Seagrass and Macroalgae Report provide the potential locations of summer flounder HAPC. As described in Section 3.1.3, areas with submerged aquatic vegetation in the Offshore Project Area are limited. Mapped seagrass beds in the Falmouth ECC are shown in Figure 4-3. The location of this HAPC may vary over the time, as the distribution of submerged aquatic vegetation and particularly macroalgae in the Offshore Project Area changes. HAPC for summer flounder is more likely to be present in warmer months (May through October).

4.4 Summary of Essential Fish Habitat within the Project Area

EFH and EFH-designated species will be affected by construction, installation, operations and maintenance (O&M), and decommissioning activities throughout the entire Offshore Project Area based in part on the life stage and habitat-type of the organism at the time of various Project activities. Table 4-3 and Table 4-4 summarize early and late benthic life stages of species with designated EFH in the Offshore Project Area and provide a description of preferred habitat for designated life stages. Table 4-5 and Table 4-6 summarize early and late pelagic life stages of species with designated EFH in the Offshore Project Area.

Table 4-3. Early Benthic Life Stages of Species with Designated EFH Potentially Present in the Offshore Project Area (Lease Area, ECCs, and Landfall Locations)

Species with Early Benthic Life Stages	Eggs	Larvae	Description of Preferred Habitat
Finfish			
Atlantic herring	Lease Area Falmouth ECC	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Mount Hope Bay ECC Aquidneck Island Landfalls Brayton Point Landfalls	<u>Eggs:</u> adhere to the bottom, often in areas with strong bottom currents, forming egg "beds" that may be many layers deep <u>Larvae</u>: transported long distances to inshore and estuarine waters where they metamorphose into early stage juveniles
Atlantic wolffish	Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Brayton Point offshore ECC	Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Brayton Point offshore ECC	<u>Eggs:</u> egg masses are hidden under rocks and boulders in nests <u>Larvae:</u> remain near the bottom for up to six days after hatching
Ocean pout	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC	N/A	<u>Eggs:</u> hard bottom habitats
Winter flounder	All (Except for Lease Area)	All	<u>Eggs</u>: bottom habitats with substrate of mud, muddy sand, sand, gravel, macroalgae, and submerged aquatic vegetation <u>Larvae</u>: pelagic and bottom waters
Witch flounder	Lease Area Brayton Point offshore ECC	Lease Area Brayton Point offshore ECC Falmouth ECC (probable)	<u>Eggs and Larvae:</u> pelagic habitats with eggs most often observed from March through October and larvae are most often observed from March through November, with peaks in May to July

Species with Early Benthic Life Stages	Eggs	Larvae	Description of Preferred Habitat
Invertebrates			
Atlantic sea scallop	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC	Eggs: coarse substrates of gravel, shells, and rocks Larvae: hard surfaces for pelagic larvae to settle, including shells, pebbles, and gravel. Larvae also attach to macroalgae and other benthic organisms such as hydroids
Longfin inshore squid	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Sakonnet River ECC	All	Eggs: occurs in inshore and offshore bottom habitats Pre-recruits: Identified for pelagic inshore and offshore waters

Note: N/A = not applicable as no EFH for this life stage is present in any Offshore Project Area

Table 4-4. Late Benthic Life Stages of Species with Designated EFH Potentially Present in the Offshore Project Area (Lease Area, ECC, and Landfall Locations)

Species with Late Benthic Life Stages	Juveniles	Adults	Description of Preferred Habitat
Finfish			
Atlantic cod	All	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC	Juveniles: bottom habitats with a substrate of gravel, cobble, and boulder habitats, especially those with attached organisms Adults: bottom habitats with a substrate of rocks, pebbles, gravel, or boulders. Also found on sandy substrates
Atlantic wolffish	Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Brayton Point offshore ECC	Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Brayton Point offshore ECC	Juveniles: distributed over a wide variety of substrates Adults: distributed over a wider variety of sand and gravel substrates once they leave rocky spawning habitats
Black sea bass	All	All	Juveniles: usually found in association with rough bottom, shellfish and eelgrass beds, and man-made structures in sandy-shelly areas Adults: structured habitats (natural and man-made), sand, and shell are preferred
Haddock	Lease Area	Lease Area	Juveniles: YOY juveniles settle on sand and gravel but are found predominantly on gravel pavement areas. As they grow, they disperse over a greater variety of substrate types. Adults: hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel substrates
Monkfish	Lease Area Brayton Point offshore ECC	Lease Area Brayton Point offshore ECC	Juveniles: hard sand, pebbles, gravel, broken shells, and soft mud; they also seek shelter among rocks with attached algae Adults: hard sand, pebbles, gravel, broken shells, and soft mud
Ocean pout	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC	Juveniles: occur on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel Adults: mud and sand, particularly in association with structure forming habitat types

Species with Late Benthic Life Stages	Juveniles	Adults	Description of Preferred Habitat
Red hake	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Juveniles: mud substrates with biogenic depressions, substrates providing biogenic complexity (e.g., eelgrass, macroalgae, shells, anemone and polychaete tubes), and artificial reefs Adults: shell beds, soft sediments (mud and sand), and artificial reefs
Scup	All	All	Juveniles: various sands, mud, mussel, and eelgrass bed type substrates Adults: demersal waters over the continental shelf
Silver hake	Lease Area Falmouth ECC	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC	Juveniles: found in association with sand-waves, flat sand with amphipod tubes, and shells, and in biogenic depressions Adults: bottom depressions or in association with sand waves and shell fragments
Summer flounder	All	All	Juveniles: demersal waters over the continental shelf Adults: demersal waters over the continental shelf
White hake	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area	Juveniles: Fine-grained, sandy substrates in eelgrass, macroalgae, and unvegetated habitats Adults: fine-grained, muddy substrates and in mixed soft and rocky habitats
Windowpane flounder	All	All	Juveniles: found on mud and sand substrates Adults: found on mud and sand substrates
Winter flounder	All	All	Juveniles: occur on a variety of bottom types, such as mud, sand, rocky substrates with attached macroalgae, tidal wetlands, and eelgrass Adults: occur on muddy and sandy substrates, and on hard bottom on offshore banks
Witch flounder	Lease Area	Lease Area Falmouth ECC	Juveniles: occur on the outer continental shelf and slope, with mud and muddy sand substrates Adults: occur on the outer continental shelf and slope, with mud and muddy sand substrates

Species with Late Benthic Life Stages	Juveniles	Adults	Description of Preferred Habitat
Yellowtail flounder	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC	Juveniles: occur on sand and muddy sand Adults: occur on sand and sand with mud, shell hash, gravel, and rocks
Invertebrates			
Atlantic sea scallop	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC	Juveniles: hardbottom benthic habitats in depths of approximately 60 to 360 ft (18 to 110 m) Adults: sand and hardbottom benthic habitats, primarily depths of approximately 60 to 360 ft (18 to 110 m)
Atlantic surfclam	Lease Area Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall	Juveniles and Adults: occur from the beach zone to a depth of about 200 ft (656 m)
Ocean quahog	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC	Juveniles and Adults: range in depths from 30 ft (9 m) to about 800 ft (244 m), prefers medium to fine sandy bottom with mud and silt
Skates			
Barndoor skate	Lease Area	Lease Area	Juveniles and Adults: mud, sand, and gravel substrates
Little skate	All	All	Juveniles and Adults: bottom habitats with a sandy or gravelly substrate or mud
Winter skate	All	All	Juveniles and Adults: bottom habitats with a substrate of sand and gravel or mud
Highly Migratory Species			
Sand tiger shark	All	N/A	Juveniles: sand, mud, and rocky substrates in coastal and shallow bays; generally near bottom
Sandbar shark	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC	Juveniles and Adults: sand, mud, shell, and rocky sediments/benthic habitat; may also be found in pelagic habitats
Smoothhound shark complex (Atlantic stock)*	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Sakonnet River ECC	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Sakonnet River ECC	Juveniles and Adults: near or on the bottom

Note: N/A = not applicable as no EFH for this life stage is present in any Offshore Project Area.
* Neonate/YOY for shark species is considered more similar to juvenile life stage than larval life stage for this analysis

Table 4-5. Early Pelagic Life Stages of Species with Designated EFH Potentially Present in the Offshore Project Area (Lease Area, ECC, and Landfall Locations)

Species with Early Pelagic Life Stages	Eggs	Larvae
Finfish		
American plaice	N/A	Lease Area
Atlantic butterfish	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Atlantic cod	All	All
Atlantic herring	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Mount Hope Bay ECC
Atlantic mackerel	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Atlantic wolffish	Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall	Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall
Haddock	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Monkfish	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Offshore hake	N/A	Lease Area Falmouth ECC
Atlantic pollock	Lease Area Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Red hake	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Silver hake	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls

Species with Early Pelagic Life Stages	Eggs	Larvae
Summer flounder	All	All
White hake	N/A	Falmouth ECC and Brayton Point Offshore ECC
Windowpane flounder	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Witch flounder	Lease Area Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Yellowtail flounder	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Invertebrates		
Longfin inshore squid	Lease Area Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Brayton Point offshore ECC Sakonnet River ECC	All

Note: N/A = not applicable as no EFH for this life stage is present in any Offshore Project Area.

Table 4-6. Late Pelagic Life Stages of Species with Designated EFH Potentially Present in the Offshore Project Area (Lease Area, ECC, and Landfall Locations)

Species with Late Pelagic Life Stages	Juveniles	Adults
Finfish		
Atlantic butterfish	All	All
Atlantic herring	All	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Atlantic mackerel	All	Lease Area Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Bluefish	Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC Brayton Point Landfalls
Silver hake	Lease Area Falmouth ECC	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Aquidneck Island Landfalls Mount Hope Bay ECC
Spiny dogfish	Lease Area	Lease Area Falmouth ECC Brayton Point offshore ECC
White hake	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area
Invertebrates		
Longfin squid	All	All
Northern shortfin squid	N/A	Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall
Highly Migratory Species		
Albacore tuna	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfalls Shore Street Landfall Sakonnet River ECC	Lease Area Falmouth ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Brayton Point offshore ECC

Species with Late Pelagic Life Stages	Juveniles	Adults
Basking shark*	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Blue Shark*	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Bluefin tuna	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Worcester Avenue/Central Park Landfall Shore Street Landfall	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall
Common thresher shark*	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall
Dusky shark*	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Porbeagle shark*	Lease Area	Lease Area
Sandbar shark*	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Shortfin mako shark*	Lease Area Falmouth ECC Brayton Point offshore ECC	Lease Area Falmouth ECC Brayton Point offshore ECC
Skipjack tuna	Lease Area Falmouth ECC	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Worcester Avenue/Central Park Landfall Shore Street Landfall
Tiger shark	Lease Area Falmouth ECC	Lease Area Falmouth ECC
White shark*	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Sakonnet River ECC (neonate) Aquidneck Island Landfalls (neonate) Mount Hope Bay ECC (neonate)	Lease Area Falmouth ECC Brayton Point offshore ECC Worcester Avenue/Central Park Landfall Shore Street Landfall
Yellowfin tuna	Lease Area Falmouth ECC Brayton Point offshore ECC Sakonnet River ECC Worcester Avenue/Central Park Landfall Shore Street Landfall Aquidneck Island Landfalls Mount Hope Bay ECC	Lease Area Brayton Point offshore ECC

Note: N/A = not applicable as no EFH for this life stage is present in any Offshore Project Area.
*Neonate/YOY for shark species is considered more similar to juvenile life stage than larval life stage for this analysis.

5.0 Effect Intensity Characterization

This section discusses the characterization of the intensity of potential effects to EFH and protected fish species associated with the Project. This assessment draws upon the characterization of resources presented in Sections 3.0 and 4.0.

5.1 Effect Characterization Approach

The following provides a description of the approach used to characterize effects of the Project on resources (receptors) within or in the vicinity of the Project. This approach used in this Report includes three primary steps:

- Identification and characterization of Impact-Producing Factors (IPFs);
- Identification of potentially affected resources; and
- Effect intensity characterization.

5.1.1 Impact-Producing Factors

BOEM (2020a), in its *Information Guidelines for a Renewable Energy Construction and Operations Plan (COP),* identified primary potential IPFs potentially affecting biological resources. These were adapted for use in this assessment. Section 3.4 of the COP provides a full description of the IPFs.

Based on an assessment of the Project activities described in Section 2.0 and Section 3.1, Table 5-1 below provides definitions of the criteria used to qualitatively assess the anticipated effect intensity with the effect being any change to the resource brought about by the presence of a Project component or by the execution of a Project activity.

Table 5-1. Effect Criteria Qualitative Definitions

Key Intensity Effect Criteria[a]	Definitions
Nature	• Positive – An effect that is considered to represent an improvement to the baseline or to introduce a new desirable factor. • Negative – An effect that is considered to represent an adverse change from the baseline, or to introduce a new undesirable factor.
Type	• Direct – An effect created as a direct result of the Project or Project activities. • Indirect – An effect which may be caused by the Project but will occur in the future or outside the direct area of Project influence.
Reversibility	• Temporary – Effects that are transient, intermittent or occasional in nature (reversible). • Permanent – Effects that occur during the development of the Project and cause a permanent change in the affected impact indicator or resource that endures substantially beyond the Project lifetime (irreversible).
Duration	• Short-Term – Effects that are predicted to last only for a limited period (less than four years) but will cease on completion of an activity, or as a result of mitigation measures and natural recovery. • Medium-Term – Effects that will occur over a period of four to 10 years. This will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended period of time. • Long-Term – Impacts that will occur over an extended period (more than 10 years). This will include impacts that may be intermittent or repeated rather than continuous if they occur over an extended period of time.

Key Intensity Effect Criteria[a]	Definitions
Geographical Extent (Area)	• Local – Effects that alter or influence locally important resources or are restricted to a single (local) administrative area or local community (not widespread). • Regional – Effects that alter or influence regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries (widespread). • National – Effects that alter or influence nationally important resources, affect an area that is national important/protected or macro-economic consequences (widespread).
Cumulative	• Cumulative – Direct or indirect effects that could have a greater expression due to the proximity and timing of other activities in the Project Area. • Synergistic - Direct or indirect effects that could have a greater expression due to the additive or interactive nature of the effect in a place and within a time.

Notes:
(a) Intensity effect criteria and definitions adapted from IISD (2016).

Based on that qualitative assessment and the application of professional judgment, each anticipated effect is assigned one of the intensity levels defined in Table 5-2.

Table 5-2. IPF Intensity Levels and Defining Characteristics

IPF Intensity Level	Example Characteristics
High	• Negative effect is permanent (irreversible). • Long-term duration of negative effects (more than 10 years) that are widespread. • Effects that influence or alter nationally important resources (e.g., federally listed or managed species). • Effects that change ambient conditions to cause (or reasonably may cause) death or injury with population level effects to non-protected species. • Changes to ambient conditions that may cause death or injury to a protected species and could influence overall species survival. • Cumulative or synergistic effects will occur, or may be reasonably expected to occur and have population level effects on non-protected species
Medium	• Medium-term duration of effects (five to 10 years) that are geographically widespread (national or regional). • Direct or indirect effects that are temporary (reversible), with recovery over a longer period. • Water contamination, coastal pollution by toxic or slightly biodegradable products and/or hazardous substances. • Introduced sound level resulting in death or injury of individuals of a protected species, however no impact to the survival of the species.
Low	• Shorter-term effect (one to four years), local and reversible. • Level of water and coastal pollution detectable, but below thresholds known to have a negative effect on wildlife (e.g., fish). • Acceptable sound level below the thresholds known to cause injury to resident and migratory fish populations; sound level causing only minor behavioral shifts to protected species.

IPF Intensity Level	Example Characteristics
Very Low	• Short-term impact (less than one year), local and reversible. • Little to no change in the ecosystems and/or landscape. • Waste effluents released into water, air and soil/ground at near-natural concentrations. • In-water sound levels similar to background levels. • No impact on protected species.
None	• Intensity is so immaterial that any resulting impact is scoped out of the impact assessment process.

Based on an assessment of the environment described in Section 4.0, the EFH resources are assigned a **sensitivity** "ranking" based on a qualitative assessment of the criteria presented in Table 5-3, whereby sensitivity is ranked as follows: Very Low, Low, Medium and High. The degree of sensitivity of resource is, in part, based on resource's resilience, its ability to naturally adapt to changes or recover from impact.

Table 5-3. Biological Resource Sensitivity Ranking

Ranking	Resource Characteristics
High	• Numerous sensitive or protected fauna and/or flora where a high level of biodiversity can be observed; or is a protected ecosystem of regional, state or federal importance. • An already vulnerable resource with very little capacity and means to adapt to or tolerate the changed conditions.
Medium	• A few species of sensitive or protected fauna and/or flora or a sensitive ecosystem or a locally protected ecosystem or habitat. • A protected species or habitat with limited capacity and means to adapt to change and tolerate changed conditions. Adaptation may take time and/or may only be partial.
Low	• Very few individuals of sensitive or protected fauna and/or flora or is an ecosystem which is not protected at local, state or federal levels. • A resource with some capacity and means to adapt to change and maintain/improve current conditions. Adaptation may take time and / or may only be partial.
Very Low	• No sensitive or protected fauna and/or flora or is an ecosystem that is not sensitive or that is already impacted. • A resource with the capacity and means to adapt to change and tolerate the changed conditions.

5.1.2 Potentially Affected Resources

Potentially affected resources include EFH, HAPC, and protected species as described in Section 3.0 and 4.0. Resource sensitivity has been ranked as high based on the following:

- Presence of EFH;
- Presence of juvenile cod HAPC, a designated habitat of particular importance at the regional, state and federal level; and
- Potential transient presence of federally listed protected species (shortnose sturgeon and Atlantic sturgeon) within the Offshore Project Area.

5.2 Identification and Characterization of Effects and IPF Intensity

The following sections describe the potential for effects associated with planned Project activities (construction, O&M and decommissioning) for the offshore export cables and Lease Area structures. The IPF intensity is characterized under pre- and post-mitigation conditions in Table 5-5. Decommissioning IPFs are expected to be similar to those associated with construction where equipment removal and/or facility demolition is planned.

5.2.1 Sea Bottom Disturbance

5.2.1.1 Construction and Decommissioning

Construction activities with the potential to disturb bottom sediments include vessel anchoring, installation of foundations, installation of export cables and inter-array cables, and placement of scour protection. These activities are expected to result in temporary, short-term, localized increases to turbidity, particularly in waters closest to the seafloor, as well as direct disturbance of habitats within the limit of disturbance. Within the context of the Project, effects are neither cumulative nor synergistic.

The Project will implement a comprehensive communication plan and a Fisheries Communication Plan (see Appendix W, Mayflower Wind Fisheries Communication Plan) to keep relevant marine stakeholders informed of the Project activities especially during the construction and decommissioning phases. This will include the distribution of notices to inform mariners of Project-related activities within the offshore ECCs and Lease Area.

Installation of WTG and OSP foundations will result in localized temporary sediment resuspension. Placement of the materials for scour protection may also result in a temporary increase in suspended sediments due to resuspension of bottom sediments as the rock is placed. However, such effects are expected to be short in duration, and localized in extent.

The placement and long-term presence of WTG/OSP foundations and associated scour protection in the Lease Area will result in the permanent alteration of benthic EFH habitat. However, as noted in the Benthic and Shellfish Resources Characterization Report (COP Appendix M), the seafloor habitat within the Lease Area is homogeneous sand plains which are prevalent throughout the OCS. Species preferring hard-bottom habitat (e.g., Atlantic cod) would have increased habitat availability from scour protection around foundations, while other species will continue to have large areas of preferred available habitat nearby. The vertical surfaces on WTG substructures would also introduce a source of new hard substrate, a scarcity in the marine environment. The succession order of colonizing species on the vertical surfaces depends on a range of factors including seasonal larvae abundance and the material of the structure. Over time, surface complexity of the vertical surfaces is expected to increase and coupled with the new habitat created at the WTG/OSP foundations the WTG/OSP areas are expected to function as artificial reefs with an increase in species diversity.

The installation of the export cables and the repositioning of sediment within the ECCs will result in dredged material being sidecast or backfilled, or temporarily disturbed and suspended if plowing or jet plowing installation methods are used. Sediment in the Lease Area largely consists of fine sand, very fine sand, and silt and the he southwestern portion of the Lease Area contains larger amounts of silt, and non-negligible amounts of clay are observed (COP Appendix F2, Scour Potential Impacts from Operational Phase and Post-Construction Infrastructure). These activities may cause a temporary increase in suspended solids in the water column close to the installation area due to sediment remobilization. Areas with coarser sand and gravel-sized particles are found in some areas with stronger waves and currents (COP Appendix F2, Scour Potential Impacts from Operational Phase and Post-Construction Infrastructure). The sediment distribution is expected to return to its original condition after cable installation due to these external forces.

To assess the potential impacts from cable placement a Sediment Plume Impact Model was conducted for the Project (COP Appendix F1, Sediment Plume Impacts from Construction Activities). The modeling calculated both plume dispersion (TSS mg/L in the water column) and sediment deposition.

The modeling indicated that TSS concentrations above 100 mg/L generally remain suspended during construction activities around the cable corridor center line for the Falmouth ECC. The 150 mg/L contour is always within 305 ft (93 m) of the export cable center line and 820 ft (250 m) of the inter-array cable center line. TSS concentrations of 100 mg/L are predicted to extend to a maximum of 555 ft (169 m) from the center line of the export cables, and 1,214 ft (370 m) from the inter-array cable center lines. The cumulative area of impact (TSS of 100 mg/L) for the entirety of the export cable and inter-array cable routes is 4,569 acres (1,849 hectares). Modeled sediment concentrations exceeding 50 mg/L are generally limited to the first 16 ft (5 m) above the seafloor, although they can reach 16 ft (10 m) above seafloor in the case of the inter-array cables. TSS dissipates upon cessation of construction activities. TSS along the Brayton Point ECC are expected to be similar.

Turbidity levels associated with Horizontal Directional Drilling (HDD) dredging at the Falmouth landfall sites are much smaller than those associated with cable trenching of dredging with concentrations. TSS levels exceeding 100 mg/L are predicted at a maximum distance of 118 ft (36 m), affecting a cumulative area equal or less than 1 acre (0.4 hectare).

In all simulated scenarios the maximum TSS level dropped below 10 mg/L within two hours and below 1 mg/L after less than four hours. As discussed in Section 3.4.1, the level of mortality for highly sensitive species may include values of TSS of >1,000 mg/L that persist for 24 hours. The minor short-term increase in turbidity would not affect nearshore seagrass and macroalgae habitat (COP Appendix K).

Mayflower Wind anticipates use of HDD for the installation of the export cables in the shallower areas closer to shore, which would reduce the effects of sediment disturbance on all fish habitat including EFH. Individual fish may be temporarily displaced or avoid the Offshore Project Area during construction. The final export cable route selection within the ECCs will seek to avoid high value habitats that may be expected to have slower or incomplete recovery to pre-construction conditions. Disturbances to habitats would be of limited durations and individuals would be able to return to the area after installation.

In summary, seafloor deposits, water quality, and displacement impacts from cable installations and HDD dredging would be generally localized and of short duration. Habitat type and availability would remain consistent in the Offshore Project Area with the exception of the addition of new hard surfaces available on the WTG/OSP, their foundations, and associated scour protection.

Decommissioning-related seafloor disturbance would be comparable with that of construction if the structures and cables are removed. If not removed, foundations cut above the sediment line and abandonment of the ECCs and inter-array cables in place would result in no further sediment disturbance.

Based on the above information the sea bottom disturbance IPF for construction is assigned an intensity level of **Very Low** for the Lease Area and Falmouth Southern ECC, and **Low** for the Falmouth Northern ECC and potentially the Brayton Point ECC including the Sakonnet River and Mount Hope Bay portions which traverse more complex habitat with potentially longer recovery times. For decommissioning, the intensity level would be **None** if there is no removal of buried structures occurs, or **Very Low/Low** if sub-sea bottom structures are removed.

5.2.1.2 Operations & Maintenance

The long-term presence of WTG/OSP foundations in the Lease Area will not result in further disturbance to benthic EFH habitat under normal conditions, as the scour potential in the Lease Area is low and clear water conditions prevail for most of the time (see COP Appendix F2, Scour Potential Impacts from Operational Phase and Post-Construction Infrastructure).

Operation of the WTGs, inter-array cables, and associated export cables will not result in further sediment disturbance during normal operations. No effect of scour is expected on buried cables (see COP Appendix F2, Scour Potential Impacts from Operational Phase and Post-Construction Infrastructure). However, if/when required, the repair or replacement of the inter-array cables or export cables would result in additional short-term temporary localized sediment disturbances. The presence of the foundations and rock skirts would serve as habitat enhancements on an otherwise featureless benthic plain. These artificial reefs would increase habitat diversity and foraging opportunities.

Based on the above description, the resultant intensity level is **None** for routine operations and maintenance to **Very Low** for potential repair or replacement of subsurface inter-array cables or export cables.

5.2.2 Planned Discharges

5.2.2.1 Construction and Decommissioning

Vessels used during offshore construction activities may routinely release bilge water, engine cooling water, deck drainage and/or ballast water. Vessels and the construction activities offshore will comply with the regulatory requirements related to the prevention and control of discharges. Such releases would quickly be dispersed and diluted and would cease when construction is complete. Due to expected dispersion and dilution, no negative effects of discharges to animals or vegetation are expected.

Temporary avoidance of work areas by fish is expected during construction activities. This behavior would be similar to the avoidance behaviors by shallow water fish observed during heavy pleasure boat use, ferry traffic, fishing activity, or other boating activities (e.g., Soria et al., 1996; Drastik and Kubeka, 2005). Deepwater fish are unlikely to be found in the vicinity of vessels due to habitat preferences. Therefore, few individuals are expected to be near vessels during discharges and the risk of finfish direct exposure to such discharges is very small.

Decommissioning related discharges are expected to be comparable to those for construction.

Discharges are expected to occur as allowed by law, and will be temporary, short-term, and highly localized. Due to the types, quantities and potential frequency of discharges, added to dispersion and dilution processes, the intensity level of discharges during construction and decommissioning is **None** to **Very Low**.

5.2.2.2 Operations and Maintenance

Vessels used in the long-term O&M of the Project will have planned discharges, similar to those described for construction. Given that O&M will require very few vessels compared to construction, the risk of occurrence for vessel planned discharges would be substantially reduced from those expected during construction and the intensity level of discharges would be **None** to **Very Low**.

5.2.3 Accidental Events

5.2.3.1 Construction and Decommissioning

Fuel spills or leaks from vessels could affect fish and EFH. Vessels engaged in construction may also experience unplanned releases of oil, solid waste or other materials. During the construction period, increased vessel traffic in the area of construction and at nearby ports may increase the likelihood of unplanned releases.

Offshore structures also contain small quantities of coolants, oil, and other lubricants. Therefore, the potential exists for the unplanned release of such material during construction and decommissioning of the structures.

Temporary avoidance by fish is expected during construction activities, similar to the avoidance behaviors observed during heavy pleasure boat use, ferry traffic, or heavy fishing activity. Therefore, the risk of finfish direct exposure to such events is very small.

The Project’s Oil Spill Response Plan (OSRP) (COP Appendix AA, Oil Spill Response Plan) will be implemented to prevent and control accidental releases.

Based on the above information, accidental events were assigned a **Very Low** intensity level.

5.2.3.2 Operations and Maintenance

Vessels used in the long-term O&M of the Project have the potential for accidental releases, similar to those described for construction. Given that O&M will require very few vessels compared to construction, the risk of occurrence for accidental releases is far less than for construction. Accidental events during O&M is **None** to **Very Low** intensity.

5.2.4 Direct Injury or Death

5.2.4.1 Construction and Decommissioning

During construction, the installation of the WTG and OSP foundations, as well as placement of scour protection (rock material), will result in direct mortality of sessile species and life stages (e.g., benthic infauna, shellfish, demersal eggs) in the foundation and scour protection footprint. The placement of rock material could injure fish that remain or are passing through the area during rock placement. However, it is expected that most fish would leave the area given ongoing activities, thus avoiding potential death or injury.

Sessile and or slow-moving organisms in the direct path of cable laying equipment may be injured or die during construction. Likewise, some sessile or slow-moving organism may be injured or die as a result of burial from sidecast sediment, within the cable backfill, or sedimentation resulting from the installation. Such effects are highly localized and limited to the actual duration of cable laying.

If installation of the inter-array cables and export cables is completed using a jet plow/trencher, then installation would require water withdrawals, which could in turn result in entrainment or impingement of fish. Entrainment occurs when small aquatic organisms, including plankton, fish eggs, and larvae pass through the intake screen on the intake water. Impingement occurs when fish or other larger organisms are pinned or trapped against the screens of the intake. Jet plows generally withdraw surface water for use in operations, and the intake in screened to minimize entrainment of small fish. Ichthyoplankton (fish eggs and larvae) and potentially very small, slow-moving juvenile fish would likely be entrained during the operation and larger organisms could be impinged. Mortality is expected for most impinged and entrained organisms. As indicated in Table 5-4, a large volume of water may be used during construction. While this is a large volume of water, it is a very small fraction of the total pelagic habitat available to zooplankton. Such effects would be highly localized to the position of the water intake and would be short-term with no lasting effect on populations once construction is complete.

Table 5-4. Estimated Water Withdrawal During Construction

Component	Falmouth ECC	Brayton Point ECC	Inter-Array Cables
Assumptions			
Number of Cables	Up to 5 (a)	Up to 6 (b)	1
ECC/IAC Distance	87 mi (140 km)	124 mi (c) (200 km)	497 mi (d) (800 km)
Advance Rate	0.12 mi/hr (0.2 km/hr)	0.12 mi/hr (0.2 km/hr)	0.12 mi/hr (0.2 km/hr)
Jet Trencher Water Use Rate (e)	634 thousand gallons/hr (2,400 m^3/hr)	634 thousand gallons/hr (2,400 m^3/hr)	634 thousand gallons/hr (2,400 m^3/hr)
Calculations			
Total Time per cable	700 hours	1,000 hours	4,000 hours
Water Use per Cable	443 million gallons (1.68 million m^3)	634 million gallons (2.4 million m^3)	2.5 billion gallons (9.6 million m^3)
Total Water Withdrawal	2.2 billion gallons (8.4 million m^3)	3.8 billion gallons 14.4 million (m^3)	2.5 billion gallons (9.6 million m^3)

Notes:
(a) 4 cables and 1 communications cable.
(b) 4 power cables and 2 communications cables.
(c) Conservatively assumes each cable will be installed separately. HVDC cables likely to be installed in a bundled configuration over the majority of the cable route, effectively reducing water withdrawal by a factor of 3 (3 cables installed within each cable bundle using the equivalent water withdrawal of 1 cable).
(d) Total length of cable.
(e) The export cable installation may use a large jet trencher such as a Q-Trencher 1400, which would be a conservative estimate for size of trencher. Value presented is a conservative estimate of the water flow through this model of trencher.

Decommissioning, with removal of structures above the seafloor, is not expected to result in high levels of injury or death to fish, shellfish, other benthic or epi-benthic organisms. If structures (foundation or cables) below the seafloor are removed during decommissioning, effects would be similar to those for construction.

Based on the above information the potential for direct injury or death associated with construction activities, the intensity level is **Very Low** for WTG/OSP foundation installations as well as cable installations.

5.2.4.2 Operations & Maintenance

Once the construction ceases, so too will any further habitat modification or disturbances. Marine organisms will begin to colonize and adapt to the new structures. The IPF intensity associated with long-term O&M is **None**.

5.2.5 Introduced Sound

5.2.5.1 Construction and Decommissioning

Managed fish species and water column EFH could be affected by underwater sound generated during construction and decommissioning activities. Increased sound effects on EFH species range from minor changes in behavior, to injurious and lethal barotrauma (e.g., rupturing of swim bladders). Cod and sole species have been shown to be affected by pile driving noise, increasing their swimming speed and exhibiting avoidance behaviors (Mueller-Blenkle et al., 2010). The most potentially deleterious underwater sound sources are those derived from pile driving. The degree to which a fish is affected by noise is dependent on several factors (e.g., distance of the fish from the pile, species, substrate).

As identified in Section 3.4.2, there are known thresholds for Peak, cSEL and RMS. The driving of steel monopiles may exceed these thresholds in close proximity to the activity, and may result in some mortality, injury, and behavioral avoidance responses by fish. The Underwater Acoustic Assessment (COP Appendix U2, Underwater Acoustic Modeling of Construction Sound and Animal Exposure Estimation for Mayflower Wind Energy LLC) provides the results of sound modeling associated with the foundation pile driving. Mortality or injury due to sound exposure would only occur in the immediate vicinity of the pile driving. Behavioral disturbances may occur up to 10.6 mi (17 km) away, depending on the jacket foundation/monopile size, hammer energy, and fish size (see Section 3.7 of COP Appendix U2 for detailed tables).

Temporary avoidance by fish, which would reduce direct injury, is expected during construction activities similar to the avoidance behaviors observed during heavy pleasure boat use, ferry traffic, or heavy fishing activity. Fish are expected to return to the area and associated EFH after construction is complete. Behavioral disturbances experienced at areas distant from construction would be short-term and temporary. The impact intensity to fish species would be medium during construction (pile driving) and very low to low during operation. While pile driving activities would displace individuals, fishes would not be permanently deterred from foraging or otherwise using EFH in the Offshore Project Area.

Decommissioning will involve use of sound producing activities but would be considerably less than for construction.

The introduction of sound associated with construction activities will be temporary, short-term, and localized. The assigned intensity level for sound introduction during construction and decommissioning is **Low**.

5.2.5.2 Operations & Maintenance

WTG operation may introduce sound into the underwater environment during operation. A study of sound generation from the normal operation of three different types of turbines in Denmark and Sweden (Tougaard & Henriksen, 2009) found that sound water measured above ambient levels at frequencies below 500 Hz. Tougaard and Henriksen (2009) observed total sound pressure level in the range 109–127 dB re 1 µPa RMS, measured at distances between up to 65 ft (20 m) from the foundations. These observed sound pressure levels were less than the behavior threshold for 150 dB re 1 µPa RMS (behavioral) established for sturgeon by NOAA (NOAA, 2019), as discussed in Section 3.4.2.2. It is highly unlikely that the sound levels during operation of WTGs will cause physical damage to fish (Thomsen, et al., 2006).

The introduction of sound associated with O&M will be temporary, long-term, and localized. The assigned intensity level for sound introduction during O&M is **None** to **Very Low**.

5.2.6 Changes to Ambient Lighting

5.2.6.1 Construction and Decommissioning

Fish response to lighting is highly species specific and depth dependent. Temporary construction lights may temporarily alter species behavior (some species may be attracted to the light, whereas other species may relocate to nearby, less illuminated areas). Lighting impacts will be temporary, short-term and highly localized. Therefore, an intensity level of **None** has been assigned to this IPF.

5.2.6.2 Operations & Maintenance

Impacts to lighting would be similar as addressed above.

5.2.7 Changes to EMF

5.2.7.1 Construction and Decommissioning

Construction and decommissioning will have no or de minimis effect on existing EMF within the Offshore Project Area. Therefore, the intensity level for this IPF is **None**.

5.2.7.2 Operations & Maintenance

Operation of the inter-array cables and export cables will result in the generation of EMF. The transmittance of EMF waves would largely depend on the burial depth and configuration of the cables, protective materials placed above them and the operational loads on those cables. A recent report prepared for BOEM (CSA Ocean Sciences Inc. and Exponent, 2019) concluded that alternating current undersea power cables associated with offshore wind energy projects within the southern New England area will generate weak EMF at frequencies outside the known range of detection by electrosensitive and magnetosensitive fishes. Even if magnetosensitive and electrosensitive marine species were known to detect and respond to 60-Hz AC EMF from submarine cables, a large fraction of marine species would still have very low sensitivity to submarine cable EMF due to the limited amount of time, if any, that they would typically spend near the submarine cables where non-negligible exposures to EMF could occur. EMF from direct current cables, as proposed for the Brayton Point ECC, is lower than that for alternating current studied.

Pelagic magnetosensitive fish species such as Atlantic salmon, Atlantic yellowfin tuna, and sharks that typically spend their time in the water column well above the seafloor will only rarely come into contact with EMF from submarine cables. Even for the demersal skate species with the greatest potential for exposure to submarine cable EMF, EMF exposures would be expected to be infrequent and very short due to the highly localized area of the cables relative to their overall habitat and due to the rapid decay of EMF levels with distance from the cables.

EMF associated with the inter-array cables and export cable operations is addressed within a separate study provided in COP Appendix P1, Electric and Magnetic Field (EMF) Assessment for the Proposed Mayflower Wind Submarine Export Cables. Based on burial depths the change in EMF associated with the inter-array cables and export cables at the seafloor will be indirect, reversible (i.e., will persist when the WTGs are in operation), long-term (over the life of the Project) and are highly localized. Based on these characteristics the IPF intensity level is **Very Low to Low**.

5.2.8 Biological Resource Displacement

5.2.8.1 Construction and Decommissioning

The installation of the inter-array cables within the Lease Area and export cables will result in the temporary alteration of benthic EFH habitat. As noted in the Benthic and Shellfish Resources Characterization report

(COP Appendix M), the seafloor habitat within the Lease Area and Falmouth Southern ECC is homogeneous sand plains which are prevalent throughout the OCS.

The Sediment Plume Modeling (COP Appendix F1, Sediment Plume Impacts from Construction Activities) predicts that sediment deposition resulting from cable installation activities will occur relatively locally. Most of the released mass settles out quickly and is not transported for long. Deposition thicknesses exceeding 5 millimeters are generally limited to a corridor of maximum width of 79 ft (24 m) around the cable corridor, although such thicknesses can be locally observed up to 591 ft (180 m) from the cable corridor.

Some benthic species exhibit mechanical and possibly physiological adaptions that allow them to survive deposition events of the magnitude commonly encountered in estuarine environments (Hinchey et al., 2006), similar to sediment deposition caused by cable installation. Burrowing bivalve clams, burrow-forming amphipods, and juvenile oysters were highly tolerant to burial, while a tube-dwelling (*Stresblospio benedicti*) was relatively unsuccessful at moving through the sediment to regain the sediment-water interface (Hinchey et al., 2006). Substrates that shift constantly due to waves and currents could reduce potential burial effects.

Greater habitat complexity, including hard bottom habitats, is found in the Falmouth Northern ECC and similar habitats are expected to be found in the shallower areas of the Brayton Point ECC. Benthic communities are expected to recolonize the impact area following construction activities. Recolonization rates of benthic habitats are driven by the benthic communities inhabiting the area surrounding the impacted region. Habitats that can be easily colonized from neighboring areas (e.g., sand sheets) are expected to quickly recover. Habitats requiring a successional series of colonizing species (e.g., deep boulder communities) depend on a range of factors, such as seasonal larval abundance, and are assumed to generally take longer to become established.

It is expected that most resident fish and mobile invertebrates would leave the immediate area of disturbance at the start of construction and would remain displaced during much of the construction period. Transient species would also be expected to avoid the area during construction. Benthic foraging species such as flounders, scup, red hake, pollock and skates would be displaced from the excavated and side casted areas until they recover, but would find suitable foraging habitat in adjacent areas, as only a portion of the seafloor in the Offshore Project Area will be disturbed. Suspended sediment levels would return to background levels within hours, as described in Section 5.2.1.

As described in the Seagrass and Macroalgae Report (COP Appendix K), efforts will be made to avoid eelgrass beds. Anchoring and spudding at the HDD exit may affect eelgrass if mapped beds cannot be avoided. These activities will temporarily resuspend soft sediments due to sediment remobilization. Eelgrass beds located near the Falmouth cable landfall location(s) may be affected by soft sediments settling on the blades/leaves suspended by anchoring or spudding. Post-construction, the habitat suitability for eelgrass and macroalgae is expected to be similar to the pre-construction condition.

Given the abundance of suitable habitat, the temporary short-term displacement is not expected to affect EFH and associated fish populations. Benthic infauna and epifauna displacement within the ECC would be temporary, and recolonization in some areas would begin soon after construction ends (e.g., Dernie et al., 2003; Lindeboom et al., 2011; Coates et al., 2014). Longer recovery times are expected for the more complex habitats of the Northern ECC.

Based on the above, resource displacement is anticipated to be of **Very Low** intensity.

5.2.8.2 Operations & Maintenance

The long-term presence of physical structures occupying the seafloor will displace benthic and epi-benthic organisms within the foundation footprint. This displacement will be offset in part by additional vertical relief and habitat created by the scour protection. Based on the above, resource displacement is anticipated to be of **Very Low** intensity.

5.3 Minimization/Mitigation of Potential Effect Intensity

Measures to mitigate the intensity of potential effects were considered for each IPF identified. A summary of the effect of these measures is provided in Table 5-5. Such measures may fall into several categories including:

- Site selection – The locations of foundations, routes, etc. will consider areas of higher ecological sensitivity;
- Regulatory compliance – compliance with applicable federal, state and location regulations that will lessen the potential for adverse effects; and,
- Construction methods – selection of construction methods which are less impact-producing.

The construction of the WTG, export cables and inter-array cables requires considerable regulatory review and consultation, input from regulatory agencies on the Project design during these processes will be incorporated into the final Project design to minimize the potential for adverse effects. Selection of construction methods that can minimize effects to sensitive bottom habitat will be used where possible. Mayflower Wind will utilize noise abatement systems (NAS) to decrease the sound levels in the water near a source by inserting a local impedance change that acts as a barrier to sound transmission. Visual and acoustic monitoring will be conducted by Protected Species Observers (PSOs) and Acoustic Protected Species Observers (APSOs) on construction and/or support vessels. Mayflower Wind will follow marine animal Clearance Zones, during construction as stipulated in the construction IHA. Soft-start measures will allow for a gradual increase in sound levels before the full pile driving hammer energy is reached. These measures will reduce the potential for and severity of effects associated with pile driving, some residual short-term risk will remain.

Table 5-5. Effect Criteria, Receptory Sensitivity, and Pre and Post-Mitigation Intensity Levels

IPF	Related Activities	Key Intensity Effect Criteria[a]	Pre-Mitigation Intensity Level[b,c]	Receptor Sensitivity Rank[d]	Mitigation Type	Post-Mitigation Intensity Level[b,e]
Sea bottom disturbance	WTG/OSP foundation installation, including pile driving, scour protection and vessel anchoring	Direct Short-term Temporary Local	Very Low	High	Selection of lower impact construction methods, where possible HDD for nearshore EC Utilize NAS	Very Low
	IAC/EC installation	Direct Short-term Temporary Local	Very Low (SECC, LA) Low (NECC, Brayton Point ECC)			Very Low (all areas)
	Decommissioning	Direct Short-term Temporary Local	None (ECCs) Low to Very Low (LA)			None (ECCs) Very Low (LA)
	WTG/OSP structures (O&M)	Negative and positive Direct Long-term Local	None (routine O&M) Very Low (repair of replacement of cables)	High	Presence of structures and scour protection provides positive benefit in diversity of habitat	None
Planned discharges	Vessel discharges (construction, O&M, decommissioning	Direct Short-term Temporary Local	None to Very Low	High	Regulatory compliance Onboard best practices	None
Accidental events	IAC, EC, WTG/OSP foundation installation and decommissioning WTG/OSP operation	Direct Short-term Temporary Local	Very Low	High	OSRP implementation	None
	O&M Vessels		None to Very Low			
Direct injury or death	WTG/OSP, EC and IAC construction	Direct Short-term Temporary Local	Very Low None (O&M)	High	Minimize scour protection to that required for protection of equipment	None – Very Low

IPF	Related Activities	Key Intensity Effect Criteria[a]	Pre-Mitigation Intensity Level[b,c]	Receptor Sensitivity Rank[d]	Mitigation Type	Post-Mitigation Intensity Level [b,e]
Introduced sound	WTG/OSP, EC and IAC installation WTG Operation O&M vessels	Direct Short-Term Temporary Local	Low (construction and decommissioning) None to Low (O&M)	High	Employ sound mitigation technologies or measures (e.g., warning hammer tap) APSOs on vessels Soft-start measures	None
Changes in ambient lighting	WTG/OSP, EC and IAC installation WTG/OSP O&M	Direct Short-Term Temporary Local	None	High	NA	None
Changes to EMF	Operation of IAC and EC	Indirect Short-Term Temporary Local	Very Low to Low	High	Depth of buried cables	Very Low to Low
Biological resource displacement	EC, IAC, WTG/OSP foundation installation	Direct Short-Term Permanent Local	Very Low	High	Minimize disturbance to hard bottom habitat in the NECC to the extent possible	Low
	WTG/OSP foundation structure presence (during operating life)	Direct Long-Term Temporary Local	Very Low	High	Select route to avoid complex habitats to extent possible. Minimize area of disturbance	Very Low

Notes:
(a) See Table 5-1 for definitions of Key Intensity Effect Criteria
(b) See Table 5-2 for IPF Intensity Levels
(c) Pre-Mitigation - Intensity is characterized assuming no additional efforts to avoid, minimize and mitigate effects
(d) See Table 5-3 for Receptor Sensitivity Ranking
(e) Post-Mitigation – Intensity represents relative residual effect assuming implementation of mitigation measures including avoidance, minimizing, restoration and offsetting.
EC – export cables
NECC – Falmouth Northern export cable corridor
SECC – Falmouth Southern export cable corridor
IAC – inter-array cables
LA – Lease Area
OSP – offshore substation platform
WTG –wind turbine generators (including foundations and scour protection)

6.0 Conclusions

This section summarizes the conclusions of the anticipated effects of construction, operations and maintenance, and decommissioning.

6.1 Construction

The potential negative effects to EFH, cod and summer flounder HAPC, and species using these habitats, as well as protected species (shortnose sturgeon and Atlantic sturgeon) associated with Project construction and operation are:

- Direct – the greatest potential for negative effects is associated with direct disturbance of habitat from placement of infrastructure (cables and foundations) on the seafloor.
- Reversible – affected habitats are expected to recover to pre-construction conditions through natural processes and will recolonize from adjacent undisturbed areas. In particular, benthic species will suffer some mortality through burial of the cables; however, these areas will begin to recolonize in a matter of months and ultimately reach their pre-construction population levels.
- Short-term – potential for negative effects is largely confined to the construction period, with few long-term effects affecting limited areas.
- Localized – the geographic extent of habitat effects is localized, and the affected area small relative to the available habitats within the Atlantic OCS off the southern coast of Massachusetts.
- Not cumulative or synergistic – the potential effects from various IPFs discussed in Section 5.0 are not expected to be additive or interactive and therefore Project-related effects would not be compounded or amplified.

6.2 Operations and Maintenance

Negative, effects from O&M are also considered direct, reversible, short-term, and very localized. Although, the level of negative effects of O&M is very minor when compared to construction effects. Also, the Project may realize long-term positive effects on EFH habitat and species by the creation of new hard-bottom habitat, suitable for colonization by sessile benthic and epi-benthic species, including as follows:

- Foundations and scour protection will introduce habitat diversity to a largely homogeneous sand plain. This may prove beneficial to Atlantic cod, black sea bass, and the egg and larval stages of ocean pout, thus allowing these areas to continue to serve as foraging habitat for EFH species; and
- Scour protection for inter-array cables and/or the export cables will potentially expand hardbottom habitat which are desirable to some EFH species.

6.3 Decommissioning

Effects arising from decommissioning activities would be similar to or potentially less than those described for the Project construction. Decommissioning of the Project will result in temporary disturbances to EFH and EFH species, but effects and recovery rates are expected to be short-term with no long-term effects.

6.4 Cumulative Project Level Effects

When Project activities are considered together with the existing EFH in the Offshore Project Area, the potential for negative effects associated with the construction, operation, and decommissioning of the Project on EFH are limited in scale and considered to be very low to low. The Project is not expected to cause population level changes to EFH species or resident, migratory, and/or or protected fish species. Based on the low levels of EMF (COP Appendix P1, EMF Assessment for the Proposed Mayflower Wind Submarine Export Cables) there would be no detectable effects on fish movements and the physical structures would not present an obstacle to migration and/or displace large populations of fish. The Project will provide hard substrata for marine organisms to settle upon, potentially increasing biomass and species diversity in the WTG area. Therefore, the Project will not cause long-term or permanent negative impacts to EFH or HAPC available to support fish of recreational and/or commercial importance.

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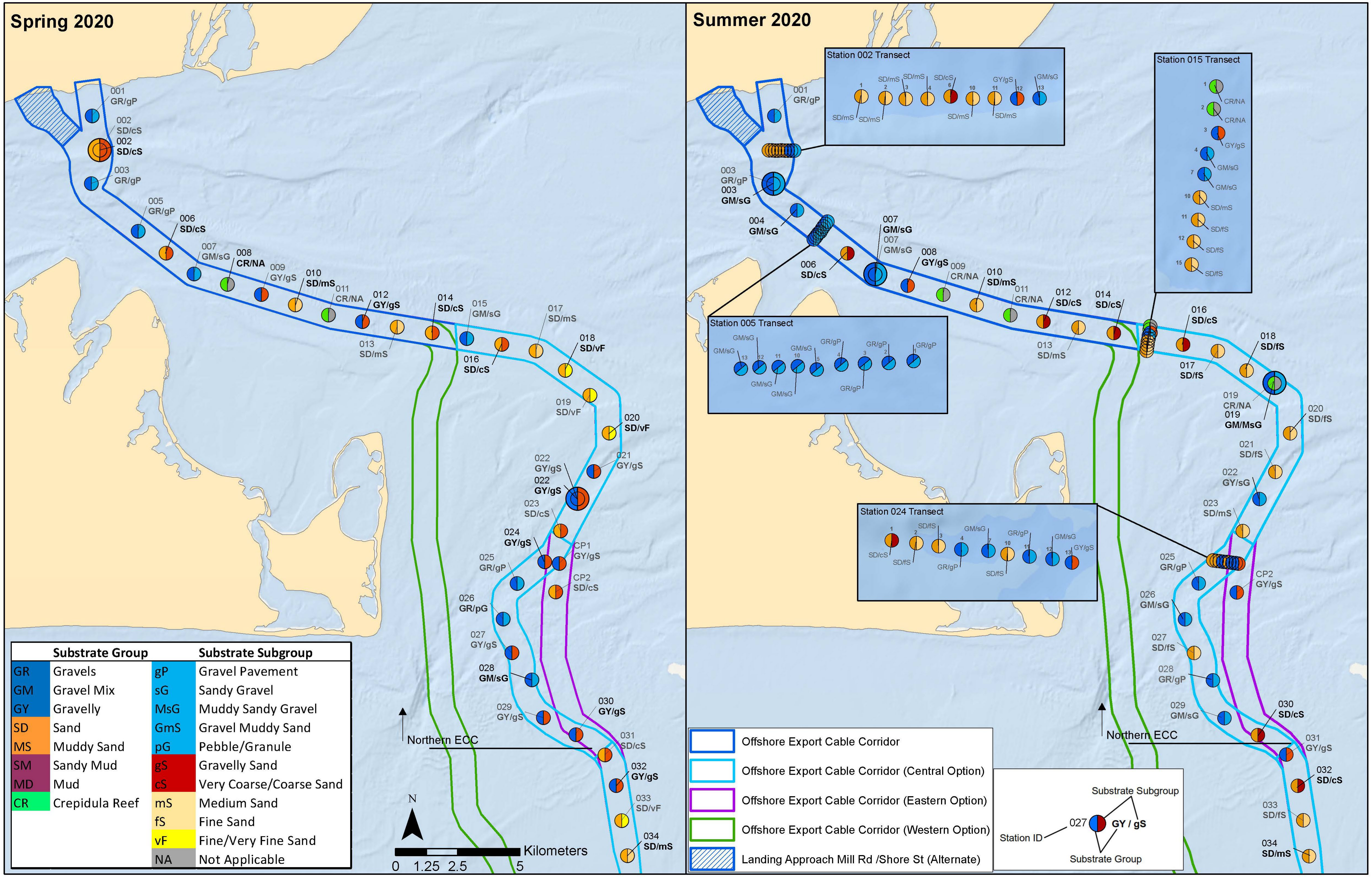
ATTACHMENT 1 – Images and Stations with Gravel Pavement from Spring and Summer 2020 SPI/PV

Attachment 1a. CMECS Substrate Classification of Gravel Pavement - Spring 2020 SPI/PV Images

Station	Substrate Group	Substrate Subgroup	Habitat Type	Complex Habitat per NMFS 2020 (Y/N)
001	Gravels	Gravel pavement	Hard bottom substrate with macroalgae	Y
003	Gravels	Gravel pavement	Hard bottom substrate with macroalgae and epifauna	Y
005	Gravels	Gravel pavement	Hard bottom substrate with macroalgae and epifauna	Y
025	Gravels	Gravel pavement	Gravel substrate	Y*

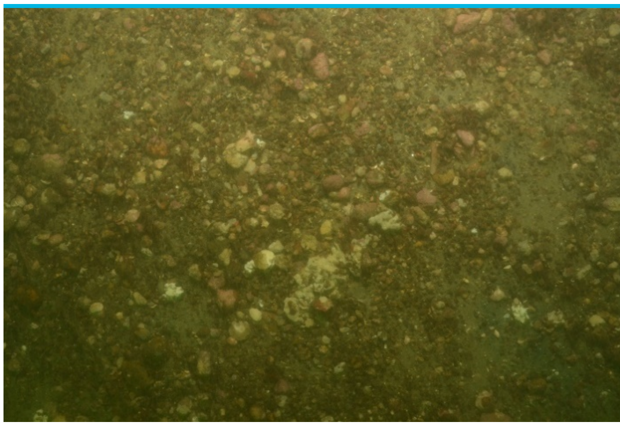
Attachment 1b. CMECS Substrate Classification of Gravel Pavement - Summer 2020 SPI/PV Images

Station	Substrate Group	Substrate Subgroup	Habitat Type	Complex Habitat per NMFS 2020 (Y/N)
001	Gravels	Gravel Pavement	Hard Bottom Substrate with Shells and Macroalgae	Y
003	Gravels	Gravel Pavement	Hard Bottom Substrate with Shells, Macroalgae and Epifauna	Y
005 - Transect Location 1	Gravels	Gravel Pavement	Hard Bottom Substrate with Sand and Shells	Y
005 - Transect Location 2	Gravels	Gravel Pavement	Hard Bottom Substrate with Sand, Shells and Macroalgae	Y
005 - Transect Location 3	Gravels	Gravel Pavement	Hard Bottom Substrate with Sand and Shells	Y
005 - Transect Location 4	Gravels	Gravel Pavement	Hard Bottom Substrate with Sand and Shells	Y
024 - Transect Location 4	Gravels	Gravel Pavement	Hard Bottom Substrate with Shells and Macroalgae	Y
024 - Transect Location 11	Gravels	Gravel Pavement	Hard Bottom Substrate with Shells and Macroalgae	Y
028	Gravels	Gravel Pavement	Hard Bottom Substrate with Shells and Macroalgae	Y



Attachment 1c. CMECS Substrate Classification including Gravel Pavement – Spring and Summer 2020

Attachment 1d. Example Images of Gravel Pavement from SPI/PV Report (Integral, 2020) – Summer 2020



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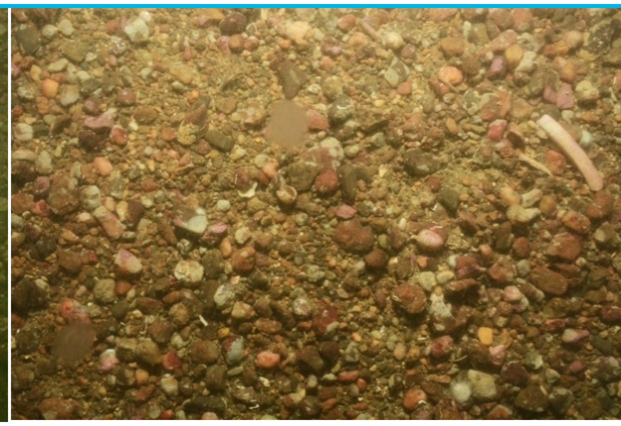

Image 20SU-MW0521-003-8

Image 20SU-MW0521-028-1

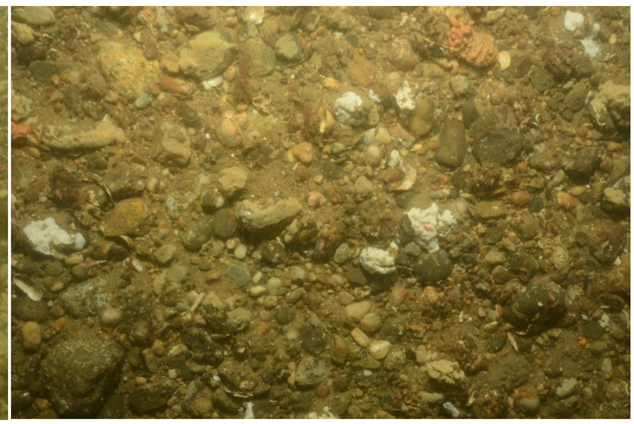

Image 20SU-MW0521-005-1

Image 20SU-MW0521-005-2

Image 20SU-MW0521-024-4

Addendum to Essential Fish Habitat and Protected Fish Species Assessment

August 2021

Since the submission of the Construction and Operations Plan (COP) for the proposed Mayflower Wind Energy LLC (Mayflower Wind) project (the Project) in February 2021, changes have been made to the Project Design Envelope (PDE). An updated Project description is included in the attached report. The following summarizes the primary changes to the Offshore Project Area:

- The Eastern and Central export cable corridor (ECC) options from the Lease Area to Falmouth have been down-selected.
- The Western option remains as the viable corridor through Muskeget Channel and has been repositioned slightly during the design.
- The Mill Road landfall location in Falmouth has been down-selected and Central Park has been added as an alternate landfall location. The Central Park landfall location is located approximately 213 feet (700 m) west of the preferred Worcester Avenue landfall location.
- A new export cable corridor has been included in the PDE. This route goes from the Lease Area to Brayton Point in Somerset, Massachusetts.

The purpose of this Addendum to COP Appendix N – Essential Fish Habitat and Protected Fish Species Assessment is to summarize the status of benthic data collected from the updated PDE.

The benthic habitat evaluation presented in COP Appendix N is based on data collected from Spring and Summer 2020, which included the original Eastern and Central route options through Muskeget Channel. The Field Sampling Plans from these events are provided as Attachments 2 and 3 to COP Appendix M (Benthic and Shellfish Resources Characterization Report).

Table 1 presents a summary of the samples that are presented and discussed in Appendix N that are no longer part of the PDE.

Table 1. Station Locations and Data Presented in Appendix M that are No Longer in PDE

Station ID	Data Collected Spring 2020	Data Collected Summer 2020
Central Route Option		
015	SPI/PV	SPI/PV
016	Benthic Grab	Benthic Grab
017	SPI/PV	SPI/PV
018	Benthic Grab	Benthic Grab
019	SPI/PV	SPI/PV/Benthic Grab
020	Benthic Grab	SPI/PV
021	SPI/PV	SPI/PV
022	Benthic Grab	SPI/PV
023	SPI/PV	SPI/PV
024	Benthic Grab	SPI/PV
025	SPI/PV	SPI/PV

Station ID	Data Collected Spring 2020	Data Collected Summer 2020
026	Benthic Grab	SPI/PV
027	SPI/PV	SPI/PV
028	Benthic Grab	SPI/PV
029	SPI/PV	SPI/PV
030	Benthic Grab	Benthic Grab
031	SPI/PV	SPI/PV
032	Benthic Grab	Benthic Grab
033	SPI/PV	SPI/PV
034	Benthic Grab	Benthic Grab
035	SPI/PV	SPI/PV
036	Benthic Grab	Benthic Grab
037	SPI/PV	SPI/PV
Eastern Route Option		
CP1	SPI/PV	Not sampled
CP2	SPI/PV	SPI/PV

Additional data has been collected during benthic surveys in Fall 2020, Spring 2021, and Summer 2021. Field Sampling Plans are provided as Attachments 4, 5, and 6 to COP Appendix M, respectively. A summary of the available data is provided in Table 2 on the following page:

Table 2. Summary of Data Collected after Spring 2020

Sample Type	Fall 2020		
	Lease Area	Falmouth ECC	Brayton Point ECC
SPI/PV	20	41 (4 not in updated PDE)	0
SPI/PV Transect	0	8 (1 not in updated PDE)	0
Video Transect	0	0	0
Benthic Grab	19	26 (3 not in updated PDE)	0
Sample Type	**Spring 2021**		
	Lease Area	**Falmouth ECC**	**Brayton Point ECC**
SPI/PV	15	8	0
SPI/PV Transect	1	13	0
Video Transect	0	3	0
Benthic Grab	18	17	0
Sample Type	**Summer 2021**		
	Lease Area	**Falmouth ECC**	**Brayton Point ECC**
SPI/PV	0	0	64
SPI/PV Transect	0	0	10
Video Transect	0	1	7
Benthic Grab	0	0	34

The data from the recent benthic surveys will be reported and integrated with acoustic mapping data from the entire PDE in the final version of Appendix M.